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Washington Highlights

Outright ownership of lands under marginal seas was given coastal states in legislation approved by the Senate judiciary committee. The bill, similar to one passed by the House, was sent to the full Senate by a 6 to 5 vote. Terms of the measure call for vesting in the coastal states clear-cut title to tidal lands in a three-mile belt beyond the low tide mark. The House bill, already on the Senate calendar, can be brought up for consideration at any time. The measure was placed on the calendar by Senator Downey of California, through procedure, little-used but capable of preventing its referendum by committee. Downey made known at that time that he was concerned as to whether or not the judiciary committee would be permitted to vote on the measure, and that he wished to keep the House bill on the calendar where it would be called up.

Congressional testimony has disclosed that the Government sold 206 tankers during 1947, a few months before the country faced a serious shortage of oil. Details of the sale were unfolded before a House appropriation subcommittee by Adm. W. W. Smith, Maritime Commission chairman and his staff. Smith said that if the tankships had been retained by the United States the pinch of the oil scarcity last fall and winter would have been somewhat alleviated. He also indicated that the vessels could have increased the U. S. tanker fleet to the minimum number required by an emergency. The U. S. is now 116 tankers short of the number needed.

The Bureau of Mines has released a report showing a detailed analyses of crude oils from 283 important oil fields in the United States. It gives means of ready comparison of the properties of crude petroleum from different sections of the country produced in fields accounting for 2500 barrels or more daily.

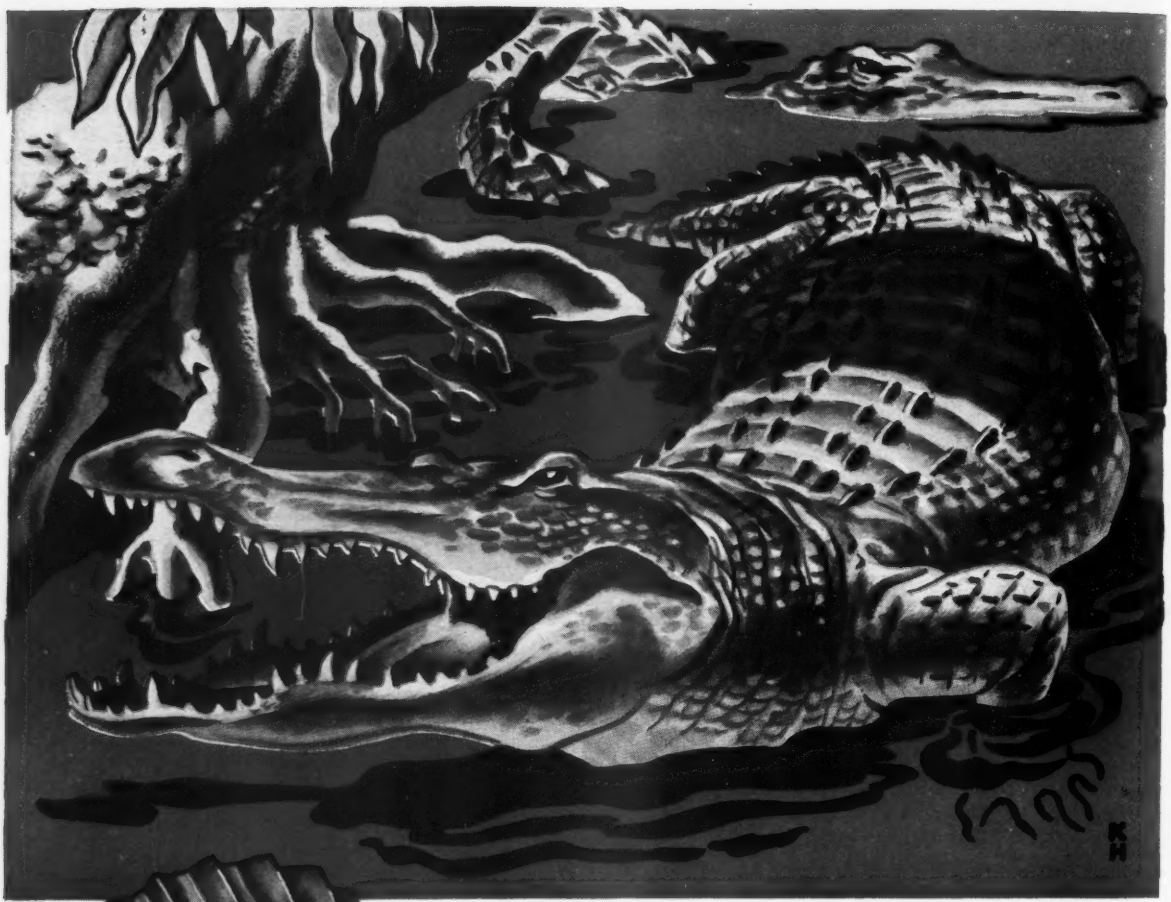
Transcontinental Gas Pipe Line Co. has received Federal Power Commission approval on a $151,000,000 pipeline to carry natural gas from the Texas Gulf Coast to the New York-Philadelphia district. Construction on the line will start this summer, with the 1840-mile line expected in operation by the fall of 1950. Sales capacity of the line is expected to reach 325,000,000 cubic ft. daily in summer and 340,000,000 in winter. The transported gas is foreseen as taking the place of some 629,000,000 gallons of fuel oil now in short supply.

The Bureau of Mines has made its first tank car shipment of crude shale oil from the Government's new plant at Rifle, Colorado. The shale oil will be fractionated at the plant of the Universal Oil Products Co. at Riverside, Illinois. After its separation the oil will be forwarded to a laboratory of Union Oil Co. in California for further study.

March, 1948, operating revenues of natural gas companies reported to the Federal Power Commission were $82,003,129, an increase of 7.7 per cent over the corresponding period last year.

Lasting Congressional approval of the Interstate Compact to Conserve Oil and Gas was recommended by the special subcommittee on petroleum of the House armed service committee in its report to Congress. Chairman Dewey Short's report was approved by all 11 committee members. The report said "in respect to conservation and efficient production of petroleum, numerous witnesses commented on the fine results which have been and are being achieved by the Interstate Oil Compact Commission. It was urged without opposition throughout the hearings that this commission be continued as a permanent entity. The subcommittee wishes merely to endorse the recommendation and to urge that the House committee of primary jurisdiction move promptly to insure that legislation be enacted to give permanent status to the commission." California is not a member of the Interstate Oil Compact Commission.

Chances for Congressional approval this session of the tax revision bill are remote. The measure, involving an estimated $400,000,000 is before the House. Drafted by the House appropriations committee, it is designed to erase a large number of tax inequities through 81 technical changes.



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Purification and Dehydration of Gases

By
C. L. Blohm and W. F. Chapin,
The Fluor Corporation

May Meeting

As the demand for natural gas for domestic fuel has increased in the last decade, it has been necessary to go to sources which do not provide naturally sweet gas. One of the largest present day sources of natural gas is the West Texas and New Mexico area, the gas from which, however, contains appreciable quantities of hydrogen sulfide, and, in order to utilize such gas in domestic service, it is necessary that the hydrogen sulfide content be reduced to a very low value because of its toxic and corrosive nature. Furthermore, certain states, in particular California, have set up very stringent standards for the hydrogen sulfide content of any gas used for domestic purposes. As a result of the above requirements, the treatment of gas for removal of hydrogen sulfide an ever increasing industry and at present millions of cubic feet of gas are so treated daily.

Early developments in the treatment of gases for hydrogen sulfide removal were engendered by the need for such treatment on other than natural gases, and, in a good many instances, perhaps for rather specific purposes where the total quantity of treated gas required was relatively small. The earliest of the methods used was the employment of lime, which system was applied almost exclusively to the hydrogen sulfide removal problem until the later development of the so-called "dry box" or iron oxide process[19]. The lime system had several objections, among which were high operating costs and the difficulty of disposing of the spent lime, so that it was rapidly replaced by the iron oxide process after the development of the latter. The iron oxide process was reasonably practical for many applications and had the advantages of being selective for hydrogen sulfide, regenerable by air oxidation, and capable of producing gas of high purity with respect to H_2S content. Incidentally, reference here and later to high purity will mean less than 0.25 grain H_2S per 100 standard cubic feet of gas. However, this system, when applied to large quantity treatment, is cumbersome in operation and quite impractical because of the large masses of treating material required, particularly when high pressure treating operations are involved. Furthermore, the handling of the spent beds is extremely hazardous because of the pyrophoric nature of the iron sulfide. Nevertheless, this system is still used to a considerable extent where it is necessary to meet stringent purity requirements under low pressure operations and where the total amount of hydrogen sulfide to be removed is small. A modification of the "dry box" method has been used in some cases in which aqueous slurries of iron oxide or other reagents have been used in a countercurrent absorption system, with or without regeneration, but has found no wide application.

Several other methods of rather minor importance have been described but need only brief mention here. Refrigeration has been employed in some cases but obviously has considerable economic disadvantages in large scale operations. Simple water or oil washing have also been employed, but here the attainable purity of the treated gas is rather low and such methods could only be used for bulk removal where high purity is not a requirement.

In 1920 the Koppers Company introduced the Seaboard Process[22] of liquid purification and since that time this process has had wide application, particularly in the treatment of sour refinery or natural gases where the volume of gas treated and the total amount of hydrogen sulfide to be removed are large. This process, as all the more recent liquid purification processes, depends upon a cyclic system involving absorption of the impurities in a contacting zone followed by regeneration of the absorbing medium in a reactivation zone and recycling of the regenerated solution for further absorption. The Seaboard Process employs an aqueous solution of sodium carbonate in a concentration of about 3 per cent and is regenerated by simple air blowing to remove the hydrogen sulfide. This system may be modified in detail for various processes, the principal modification involving means for the recovery of the sulfur either as hydrogen sulfide, elemental sulfur, or, in some cases, sulfur dioxide. However, the purity of treated gas

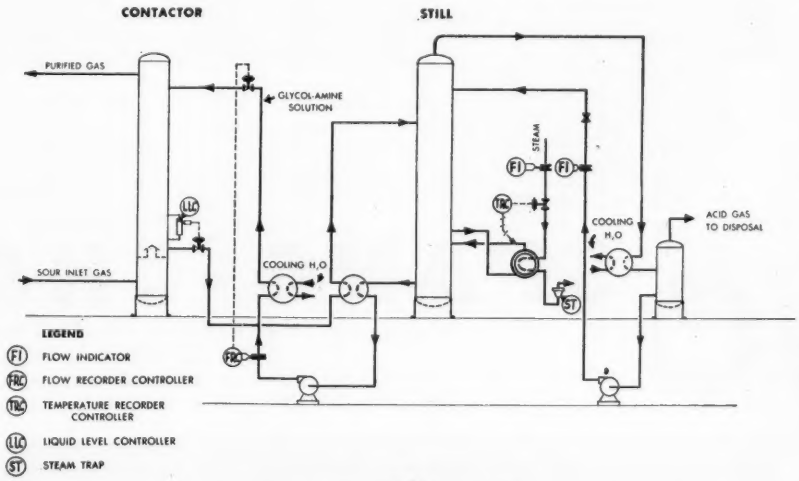

FIGURE 3
TYPICAL FLOW DIAGRAM
GLYCOL-AMINE GAS TREATING PROCESS

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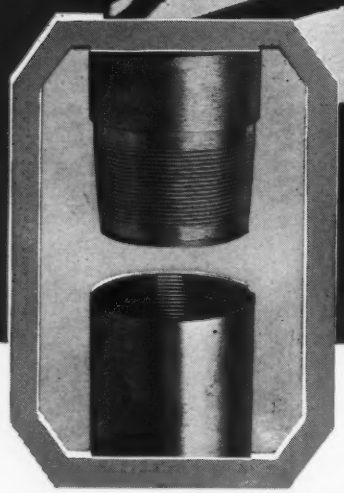

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attainable by this process is not high and the economics are not too favorable.

Chronologically, the next process of any importance was the Thylox Process[8] which employs a solution of sodium thioarsenate for absorption of hydrogen sulfide, followed by reactivation by means of oxidation with air, the sulfur being recovered as elemental sulfur in a colloidal slurry. This process has the advantage of producing a marketable by-product sulfur, but, again, does not produce gas of extremely high purity. Other processes have been used to a limited extent employing such reagents as sodium phenate[20] or naphtholate or alkali salts of essentially weak inorganic acids, such as the borate system or the Shell tripotassium phosphate[15, 23] system, all of which depend for regeneration upon pH shift in the solution at elevated temperatures.

The Shell tripotassium phosphate process employs an aqueous solution containing about 30% of the salt. The system is more or less selective for H_2S in the presence of CO_2, but again high purity is difficult to obtain. However, by going to a two-stream cycle (the general principles of which, as applied to the amine process, will be described in more detail below) it is claimed an effluent gas of good purity can be produced, although still probably not adequate to meet the most stringent specifications. In addition, the steam requirements for this system are considerably greater than for a comparable amine system for any given set of conditions.

Several other systems have been employed abroad, particularly in Germany, which have found no great application to date in this country. One of these in particular is the so called "Alkazid" Process[2] which uses as an absorption medium an alkaline salt of an amino acid such as glycine or alanine or derivatives thereof, or alkali phenates, depending on the application. Another of these which has found considerable application is the Staatsmijnen-Otto Process[16] which employs the oxidation-reduction system provided by a solution of Prussian Blue (ferriferro cyanide) with regeneration of the solution by air blowing and recovery of elemental sulfur.

All of the above treating methods have certain disadvantages, principal among which are their inability to produce gas of extremely high purity, and, in general, high steam requirements where heat regeneration is used. Nevertheless, they have been used to a considerable extent in certain applications and in particular have utility in treatment of gas for engine fuel, etc., where purity requirements are not too high.

The above introduction outlines very briefly the history and ramifications of the general field of gas treatment for hydrogen sulfide removal and brings us to the most recent and widely applied process developments. It is the purpose of this paper to discuss the latter in some detail.

As an outgrowth of the various inorganic wet purification processes and the desire to increase efficiency and attainable purity, as well as to improve the economics of large quantity treating processes, R. R. Bottoms of the Girdler Corporation investigated the application of certain organic amines to such processing. In 1930 he obtained a patent[3] which covered the use of a large number of organic amines for the removal of weakly acidic constituents from gases. However, the

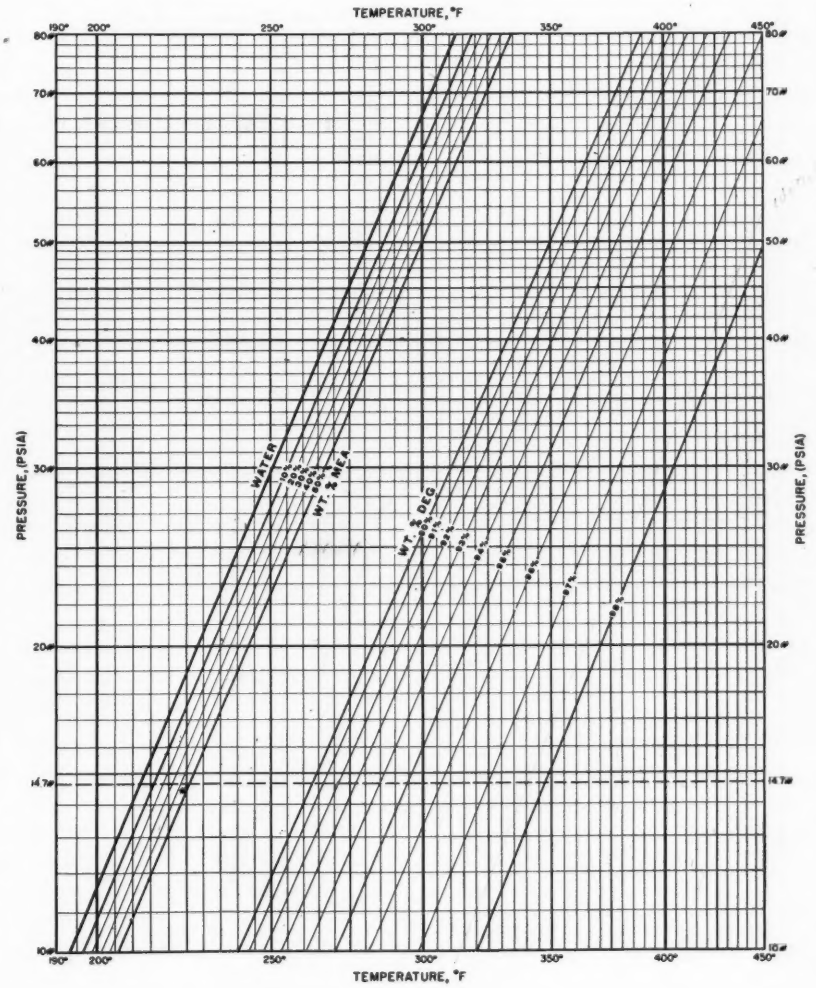

FIGURE 2

VAPOR PRESSURES OF AQUEOUS SOLUTIONS OF DIETHYLENE GLYCOL AND MONOETHANOL AMINE

amines found to be most useful at that time and subsequently to date are in the class of the alkanolamines. Earlier operations employed aqueous solutions of diethanolamine or triethanolamine since these compounds were readily available commercially. Later, however, many of the applications employed monoethanolamine as it became available at sufficiently low cost to be suitable for such application. Monoethanolamine has considerable advantage from several standpoints over its secondary or tertiary homologs, among which are greater efficiency, high basic equivalence and greater stability toward degeneration, particularly oxidative. However, diethanolamine is used in some applications where purity requirements are not too stringent. It does have the advantage, particularly in low pressure operations, of having a considerably lower vapor pressure than monoethanolamine, with consequent lower amine losses.

Based on the above application of aqueous amine solutions to gas treating, there evolved the combination Glycol-Amine Process described in the patent of A. J. L. Hutchinson in 1939.[10] This combination process offered some advantages over the previously used aqueous amine systems. The details of both processes will be discussed below.

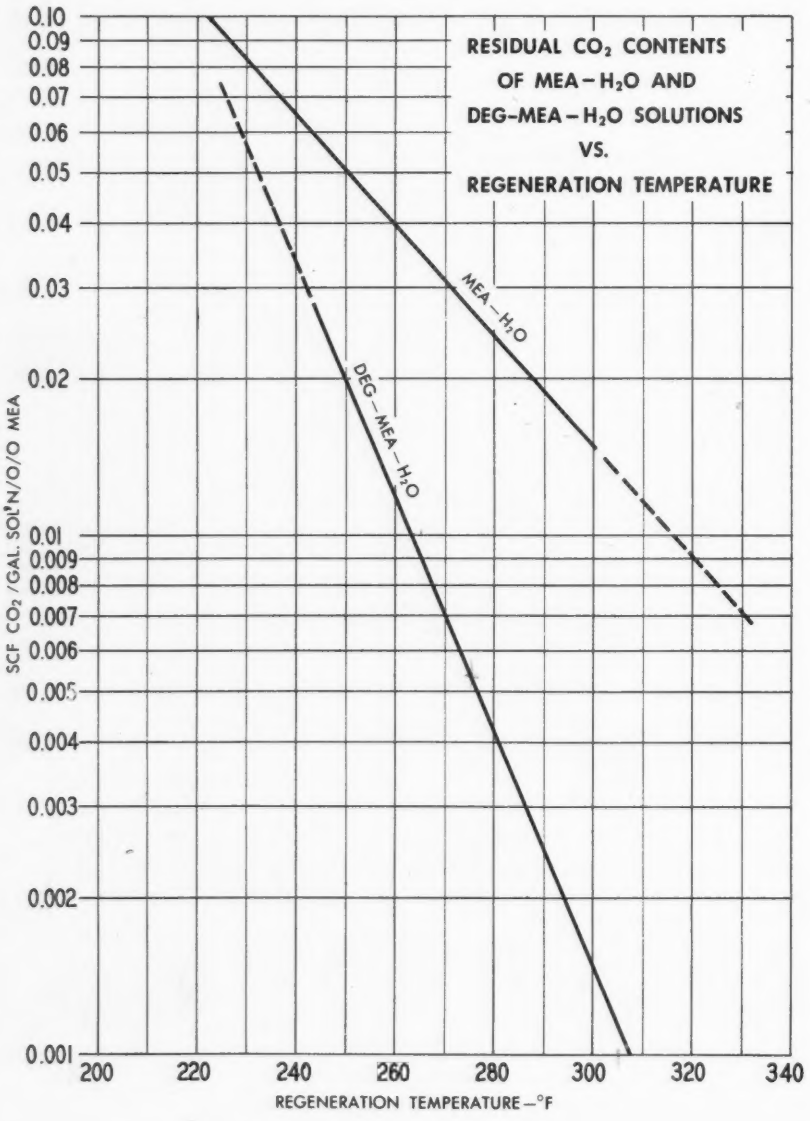

FIGURE 3

COMPARATIVE STRIPPING OF CO_2 OBTAINABLE WITH AQUEOUS AMINE AND GLYCOL-AMINE SOLUTIONS

Fundamentally, the principles of the organic amine process in either aqueous or glycol solutions are rather simple. Amines form compounds with hydrogen sulfide and carbon dioxide similar to those formed by ammonia. In the case of hydrogen sulfide, the compounds are the normal and acid sulfides. In the case of carbon dioxide, however, in addition to the normal and acid carbonates, there is the formation of organic carbamates analogous to the formation of ammonium carbamate with carbon dioxide and ammonia. In aqueous solution the percentages of normal and acid compounds, and carbamates where carbon dioxide is present, are dependent upon solution concentration, temperature and partial pressures of the acid gases. In glycol solution, the same general statement is true with the exception that the equilibria are shifted to some extent due to the decreased water activity. In either case, the equilibria between the individual constituents and the acid base complexes are reversed with increasing temperature, so that at the boiling point of the solution employed the acid gases are effectively driven out of the solution. Here again, however, the equilibrium conditions are considerably different in the glycol solutions as compared with the aqueous solutions, a fact which will be shown in the discussion below to be of considerable importance. However, consideration of the above basic principles indicates that amine solutions are readily amenable to use in cyclic processes and have general characteristics which have made them eminently suitable for the treatment of large quantities of sour refinery and natural gases.

The general chemical properties of amines are analogous to those of ammonia in many respects, and in this regard it is of interest to point out that ammono-type complexes are formed readily with metals, such as copper. Furthermore, the alkalinity of amine solutions, aqueous in particular, is sufficiently high to impart a considerable solubility to aluminum, etc. Because of these aspects, it is not possible to use cop-

per or aluminum bearing alloys in amine treating plants, and the material of construction for vessels, piping and fittings is commonly carbon steel. Stainless steel is used rarely, except for special equipment such as orifice plates in meter installations.

The application of the Girbotol Process has been described by Bottoms[4], Reed and Wood [17], Gregory and Scharmann,[9] and others in several articles and, in some of these, reasonably retailed information has been furnished on the performance of specific plants. Similarly, Bacon[1] has described the early application of the glycol-amine process and more recently this process has been described in some detail by Chapin.[5] In addition, because of the general interest in the amine treating process, several people had investigated equilibria and other factors in some detail, particularly in aqueous solutions. Mason and Dodge[12] did a rather thorough study on equilibria involved in the carbon dioxide-aqueous amine systems at partial pressures of carbon dioxide up to one atmosphere, using mono-di, and tri-ethanolamine; and, Riegger, Tartar and Lingafelter[18] have investigated the equilibria between hydrogen sulfide and aqueous monoethanolamine solutions. Maloney,[11] and Cryder and Maloney[7] have published experimental chemical engineering data on the diethanolamine-carbon dioxide system in packed columns. At about the same time, Comstock[6] reported rather extensive data on packed column performance using alkali carbonate solutions for comparison with aqueous solutions of mono-, di-, and triethanolamine. However, there is no published information on equilibria in amineglycol solutions, and it has been necessary to obtain such information for design purposes by intensive investigation, both laboratory and pilot plant, in The Fluor Corporation. In this connection it is of some interest that, because of extremely high purity attainable in the treated gas by the use of the glycol-amine process, it has been necessary to develop specialized analytical techniques in order to evaluate the degree of treating. It has been necessary to guarantee a specification of not more than 0.25 gr. H_2S/100 SCF, or 4 p.p.m., and precise analyses are essential in order to assure meeting this specification.

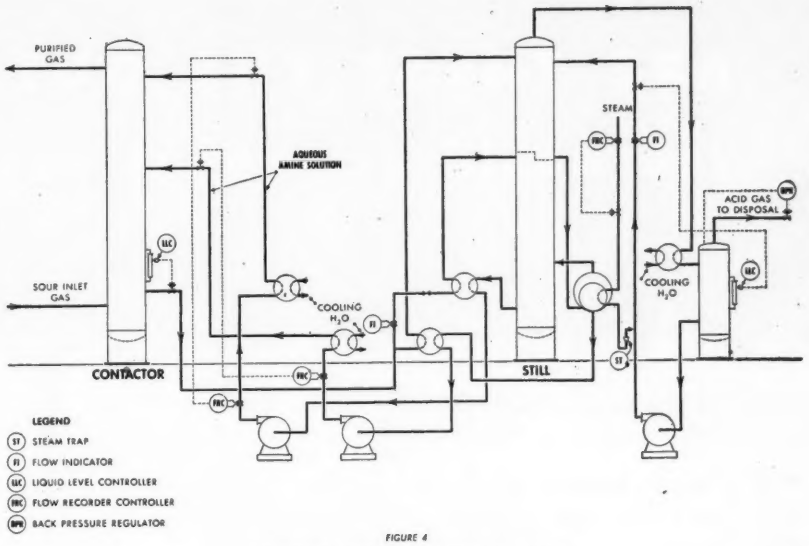

FIGURE 4

AQUEOUS AMINE SPLIT-STREAM CYCLE

The chemical properties of ethanomaline solutions make them admirably suitable for a simple cyclic process. Aqueous solutions may be used for purification of gases, while glycol-amine solutions may be utilized for simultaneous purification and dehydration. While other amines have been and are being used in gas treating processes, this discussion will be limited to the application of monoethanolamine as typical and most widely employed.

Figure 1 shows the typical flow of a glycol-amine gas treating plant. The sour gas is introduced at the bottom of the absorbing column, the contactor. The gas passes up through the bubble trays in the column where it is thoroughly contacted by the glycol-amine solution which enters at the top of the column, while the residue gas, freed of CO_2 and H_2S and dehydrated if desired, leaves the top of the column. The rich glycol-amine solution, containing the acid gases, leaves the bottom of the contactor and passes through conventional heat exchangers, where heat is exchanged with the hot lean solution; the then heated rich solution is introduced into the regenerating column, the still. The solution passes down through the still where it is heated further and stripped of its acid gas content by contact with the rising vapors in the column; the solution leaving the bottom tray is boiled in a reboiler to provide the stripping vapor. The overhead steam and acid gas stream from the still passes through a reflux condenser, and the resultant mixture is separated in an accumulator, the acid gases leaving the top of this vessel and the water condensate being pumped to the top of the still as reflux. The regenerated lean glycol-amine solution leaves the bottom of the still, passes through the exchangers and is pumped through coolers back to the top of the contactor, thus completing the cycle.

It should be pointed out here that, although the contactor, still and auxiliary equipment employed are conventional, the process involves chemical reaction and not physical absorption. This fact results in low equilibrium vapor pressures, so that few equilibrium contacts are required. However, the attainable purity of the treated gas with regard to H_2S, is controlled by one of two variables, i.e., first, the contactor efficiency and second, the equilibrium vapor pressure at the top of the contactor must be less than that determined by the purity requirement. In regard to the latter, it is obvious that the minimum H_2S vapor pressure at the top of the contactor is fixed by the H_2S content of the lean solution, and is controlled, therefore, by the effectiveness of the stripping operation.

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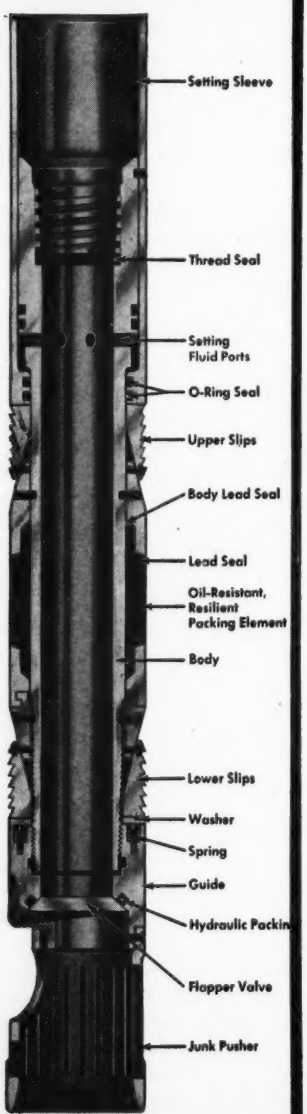

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The stripping will be discussed below in more detail.

As shown on this flow sheet, the steam to the reboiler is controlled by the temperature in the reboiler, while the reflux to the still is flow controlled, either manually or automatically. This method of control proves satisfactory, as a small change in the water content of the solution results in a significant temperature change in the boiling point of the solution. This is illustrated in Fig. 2, which shows the vapor pressure of diethylene glycol solutions plotted against temperature. Although the presence of monoethanomaline changes the actual temperatures somewhat, it may readily be seen that temperature is the most satisfactory variable to use in controlling the composition of the solution.

The typical flow scheme for an aqueous amine plant is the same as that shown for a glycol-amine plant, the only difference being that the steam to the reboiler is flow controlled, while the reflux is controlled by a level controller on the reflux accumulator. In this case the boiling point temperature change with a change in composition is not sufficiently sensitive for the use as a control variable. This fact is also shown in Fig. 2 by the lines showing the change in vapor pressure of aqueous monoethanolamine solutions with temperature.

The prime difference between the use of an aqueous amine solution and a glycol-amine solution, other than the dehydrating effect of the latter, lies in the mechanism of regenerating the solution. Since the absorption of H_2S and CO_2 in monoethanolamine solutions involves a chemical reaction, regeneration of the solution involves a reversal of this reaction. As mentioned above, the maximum purity obtainable on any gas being treated is a function of the pressure and temperature at the top of the acid gas absorption column and the amount of the acid gases remaining in the stripped lean solution. Any H_2S or CO_2 remaining in the solution will exert a certain vapor pressure at the top of the absorber, with an amount of H_2S and CO_2 equivalent to this vapor pressure being the minimum that can leave the top of the column in the treated gas. Thus, the degree of regeneration or stripping of the solution obtained in the regenerating column will determine the maximum purity of the minimum possible content of H_2S and CO_2 in the treated gas leaving the top of the absorber.

Normally an increase in pressure is detrimental to any stripping operation; however, an increase in pressure with a corresponding increase in the boiling point of an aqueous monoethanolamine solution permits more complete regeneration of the solution as far as CO_2 is concerned. This phenomenon results from the fact that dissociation of the monoethanolamine - carbon dioxide complex, which is by no means complete at the atmospheric pressure boiling point of the solution, increases rapidly enough with temperature to overcome the adverse effects of the increased pressure on the stripping. On the other hand, this is not the case with H_2S and an aqueous monoethanolamine solution. The monoethanolamine sulfide is substantially dissociated at essentially the atmospheric pressure boiling point of the solution. Thus, the benefits of increased temperature are not sufficient to overcome the adversities of the increased pressure, and the stripping of H_2S is hindered at elevated pressures. Therefore, when pressure regeneration is used for aqueous monoethanolamine solutions, with the regen-

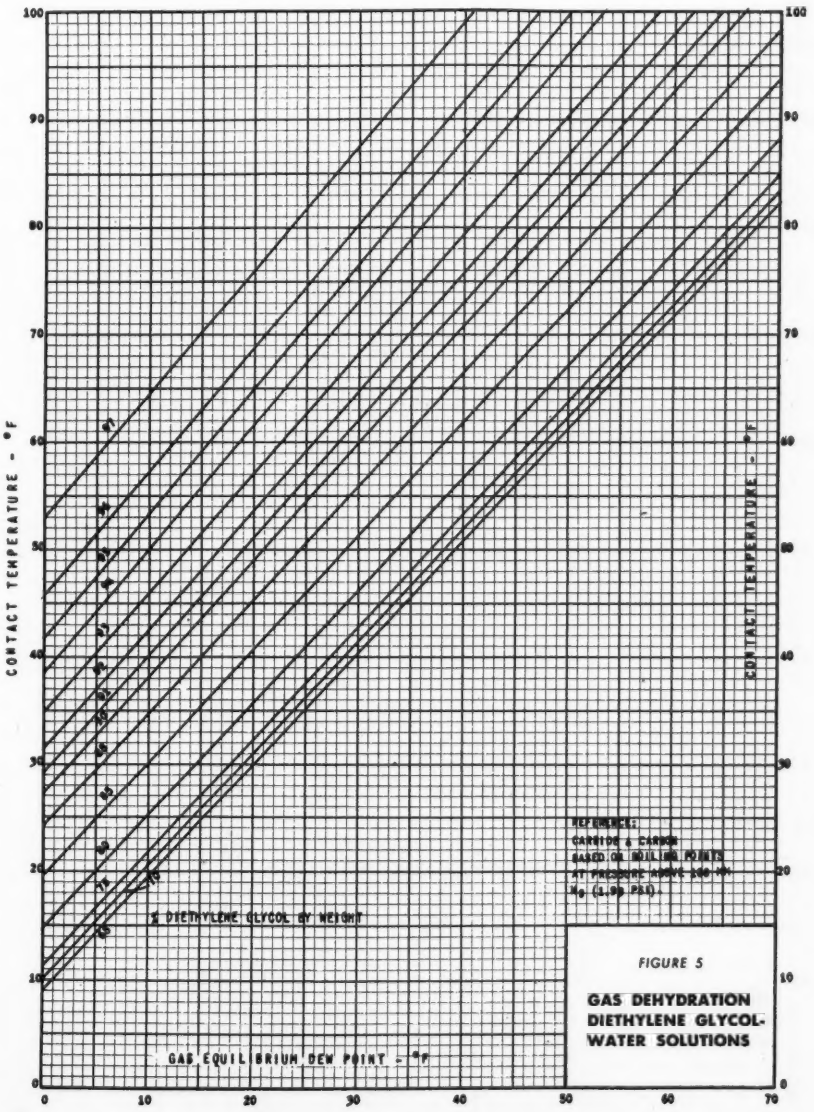

FIGURE 5

GAS DEHYDRATION DIETHYLENE GLYCOL-WATER SOLUTIONS

erating column maintained under pressure ranging up to 50 PSIG, the total amount of acid gas remaining in the stripped lean solution is markedly reduced in cases where there is an appreciable ratio of CO_2 to H_2S in the rich solution. Nevertheless although the actual quantity of H_2S remaining in the solution is less than that of CO_2, the H_2S content may actually increase with increasing regeneration pressure. In general, however, the net result of pressure regeneration is a decrease in total acid gas content of the stripped solution.

In contrast to the above, the use of a glycol-amine solution raises the regeneration temperature without pressure increase, and further, the presence of the glycol has a beneficial effect in the stripping equilibrium. Consequently, the adverse effects of pressure regeneration are not encountered, and both H_2S and CO_2 can be stripped essentially completely. This feature constitutes one of the most important advantages of the glycol-amine system.

Comparative stripping results for CO_2 obtainable with aqueous monoethanolamine and monoethanolamine-glycol solutions are shown in Fig. 3. The MEA-H_2O line, showing the effects of pressure regeneration, is based on data published by Reed and Wood[17]. The glycol-amine data (DEG-MEA-H_2O) are derived from operating plants and a pilot plant. The latter show the effect of varying the amount of water in a glycol-amine-water solution.

The difference in behavior of H_2S with the two solutions is even more pronounced than that of CO_2. Although the actual quantity of the residual H_2S is less than that of CO_2 for either solution, the divergence of the MEA-H_2O and the DEG-MEA-H_2O lines for residual H_2S content is considerably greater than that shown for CO_2.

In any event, it is obvious that any acid gas remaining in the lean solution is combined with an equivalent amount of amine, which means that sufficient excess solution must be circulated to compensate this residual. Solely on the basis of circulation requirement, then, any device which results in better stripping offers some advantage, and may be procured by either pressure regeneration of aqueous solutions or the use of glycol solutions. Again it should be pointed out, however, that the resulting attainable purity of treated gas may not be the same in both cases, due to the adverse effect of pressure on H_2S regeneration.

Under any pressure in the regenerating column more complete stripping of both CO_2 and H_2S may be accomplished by more severe boiling of the solution. Increasing the quantity of stripping vapor decreases the partial pressure of acid gas above the solution and thus reduces the equilibrium amount of acid gas remaining in the solution. It is pertinent that to obtain the stripping of CO_2 from an aqueous monoethanolamine solution by pressure regeneration as shown in Fig. 3 it is necessary to boil the solution more vigorously to generate more stripping vapor in the regenerating column than is required to obtain the stripping shown for glycol-amine solutions. With equivalent amounts of stripping vapor the divergence of the lines shown would be greater, as would be the initial distance between them. The lines shown represent approximately the economic degree of stripping for each particular solution.

A glycol-amine solution would then have a distinct advantage over an aqueous amine solution when employing a flow cycle similar to that shown in Fig. 1. As the solution does not have to be boiled as severely during regeneration, and as the circulation rate may be somewhat lower in many cases, the saving in steam consumption and cooling water circulation is considerable.

However, a two stream flow cycle may be used in the case of an aqueous amine solution which will reduce the utility consumption to a point more comparable to that of a glycol-amine solution. This arrangement is shown in Fig. 4. The rich solution from the bottom of the absorber is split into two streams, half going to the top of the still and half to the middle. Just above the point at which the middle stream is introduced to the column, the stream to the top section is drawn out, and then flows to the reboiler. This upper stream, which would not be regenerated to the same degree as that in a normal single stream plant, then flows through exchangers and coolers to the absorber, where it enters several trays down from the top. The vapors from the reboiler rise from the bottom of the still contacting the downflowing solution which was introduced in the middle of the column. Although the actual quantity of vapor rising in the column is less than for a normal single stream plant, it is contacting only half the volume of liquid flow, so the solution leaving the bottom of the still is then more completely

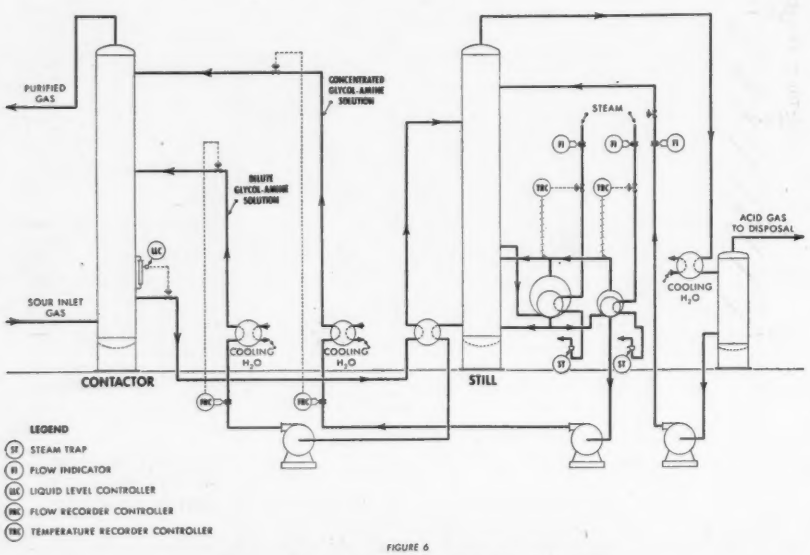

FIGURE 6

GLYCOL-AMINE COMMINGLED TWO-STREAM CYCLE

"CBV" COMBINATION BALANCED VALVES
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The right gas pressure with continuous control is a prime need supplied by the "CBV" type regulators. These are combination balanced valves built in two interchangeable styles—either offset connected or direct connected.

The offset model allows easy access to inner valve assembly through a hand hole plate. It does not require removal of the entire superstructure to examine or change the valve assembly. In changing from a high to a low pressure regulator, the diaphragm chamber unit is replaced and the rocker arm shaft is changed to a low pressure rocker arm shaft. The offset connected style has a fulcrum between the diaphragm and valve assemblies.

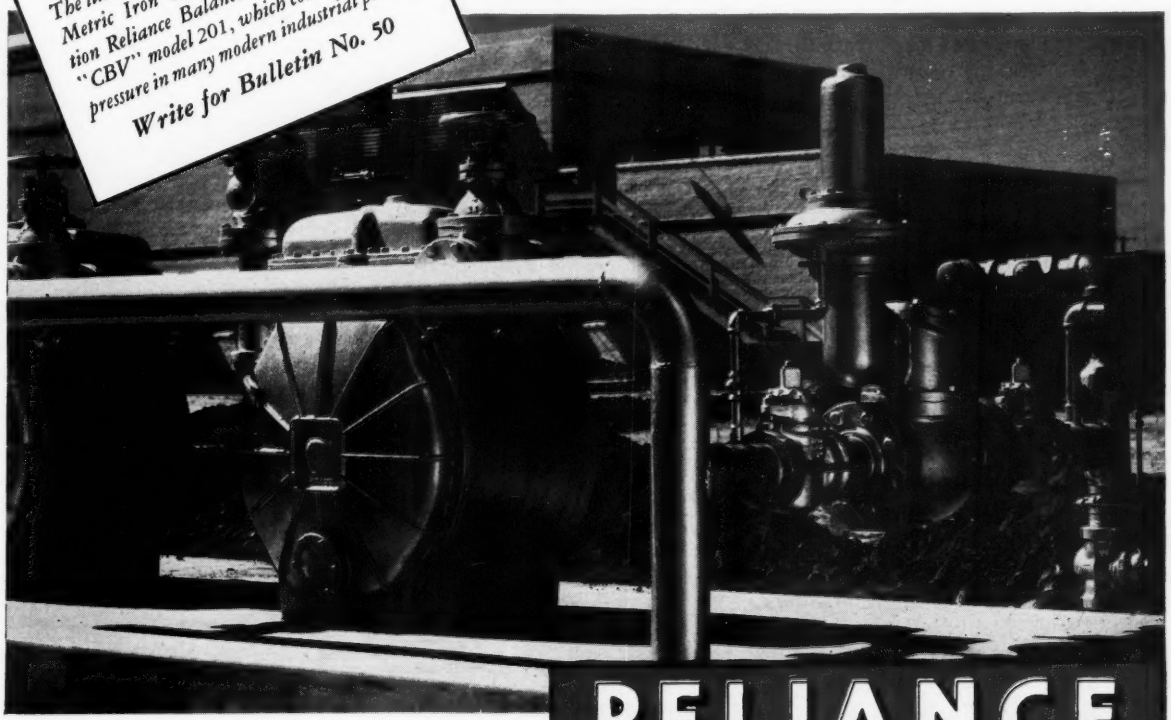
In the direct connected regulator, the diaphragm assembly is connected straight through to the valve assembly. It comes in three optional types: the high pressure weight-loaded; spring-loaded; or pilot-loaded. This model also has interchangeable parts which permit switching to a spring or pilot-loaded assembly. The change is made by replacing the pressure lever cap with the spring housing unit or with the pilot cap. These quick and easy changes help to meet new needs and specifications.

Both offset and direct connected models are offered in high pressure weight-loaded, spring-loaded, or pilot-loaded types. Low pressure models are pilot-loaded or weight-loaded, either inside or outside weights being available. Semi-low pressure regulators are made in pilot-loaded or outside weight-loaded types. The low pressure and semi-low pressure regulators are offered only in the offset style. A 3.4 to 1 ratio is maintained to provide better lock-up under low pressures.

Valve body castings are the same for either high pressure or low pressure types. A free flow of gas is provided at the point of expansion and body friction is reduced to a minimum. Directional flow arrows are cast into both sides of valve body castings for the user's convenience.

The illustration below shows an American Metric Iron Case Meter and combination Reliance Balanced Valve Regulator, "CBV" model 201, which controls the gas pressure in many modern industrial plants.

Write for Bulletin No. 50



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stripped of acid gases than that of a single stream plant. This stream is then introduced into the absorber on the top tray.

This two stream principle, employing a "lean" and a "very lean" solution, has been used in several gas treating processes, such as Shell's tripotassium phosphate process, and was first disclosed by Shoeld[21]. Although this two stream application of an aqueous amine solution saves utilities, the initial cost of the treating plant itself is increased. The still itself obviously has a higher cost as more trays are required, and the two streams require two piping systems with two sets of exchangers and coolers.

It then becomes obvious that higher purities are obtainable by the use of a glycol-amine solution than by an aqueous monoethanolamine solution inasmuch as the glycol-amine solution may be stripped much more completely of the absorbed acid gases. This is particularly important when considering the cases where extremely low H_2S quantities are specified for treated gas. A difference of but a few grains of H_2S remaining in the regenerated solution can mean the difference in meeting or not meeting a specified gas purity.

As previously mentioned, the glycol-amine process was originally developed to accomplish simultaneous acid gas removal and dehydration of a natural gas stream. It was found in the earliest application that a glycol-amine solution with the same water content as a diethylene glycol solution will dehydrate the gas to a slightly greater degree than the latter.

Fig. 5 shows the dew-points obtainable with various concentrations of diethylene glycol solutions at various contact temperatures. Although glycol-amine solutions give slightly better dehydration, this same chart may be used for estimating attainable dew-points with such solutions. Dew-point depressions of 50°F, i.e., the water dew-point of the purified and dehydrated gas is 50°F less than the contactor outlet temperature of the gas, may be reached economically by use of glycol-amine solution.

In the above discussion of dehydration, the term "dew-point' 'is used, since this terminology is common in the industry. However, reference to "dew-point" of effluent gases from liquid dehydraters has no significance when used to evaluate the water content of such gases. The gas leaving the top of a contactor has approached equilibrium with the solution on the top tray at the temperature and pressure conditions existing, so that any decrease in temperature will result in condensation of liquid from this gas, the composition of which will be approximately the same as that of the top tray liquid. On the other hand, effluent gas from a solid bed, non-volatile dehydration will contain only water, so that then a dew-point measurement is a true indication of water content. It is obvious, therefore, that in liquid dehydration systems, the precise terminology should employ absolute water content determined by other than dew-point measurements, which give completely erroneous results, the value obtained being a function solely of the operator and means of procedure. In this connection, it should be pointed out that dehydration of transmission gas is employed principally to prevent possible hydrate formation, and, since the gas from glycol-amine plants contains small amounts of these chemicals, the actual hydrate formation point can be suppressed below that corresponding to the water content of the gas alone. This effect offers some advantage in either glycol or glycolamine dehydration, the advantage being greater in the latter case.

One important factor to consider in the design of a glycol-amine plant is the temperature approach at the top of the contactor between the outlet gas and the inlet lean solution. The heats of reaction of H_2S and CO_2 with monoethanolamine are considerable, and in an improperly designed plant can cause the outlet temperature of the gas to be sufficiently high to interfere with proper dehydration. The dew-point depression would be normal, but the outlet temperature of the gas might be 100°F instead of a desired temperature of 80°F, causing almost a corresponding increase in the dew-point.

The combination glycol-amine solution for simultaneous purification and dehydration may not always be the best answer where both results are desired, the most economical choice being dependent on many factors. In many cases, particularly where the treating requirements are not rigid, a purification plant using an aqueous amine solution followed by a separate dehydration plant utilizing a straight diethylene glycol solution might prove to be the most attractive answer.

The glycol-amine process also lends itself readily to two stage cycles, wherein the gas is treated and partially dehydrated in the first stage and dehydrated in the second stage. These cycles are particularly applicable where it is desired to treat the gas at a certain pressure prior to compressing the gas for transmission, with the dehydration step taking place at the final pressure.

One such scheme circulates a glycol-amine solution containing 15 to 25% water in the equipment shown in Fig. 6, with the principal lean solution stream entering the contactor a few trays down from the top. A small side stream is taken from the reboiler to a smaller reboiler, wherein it is concentrated to about 5% water. This small stream, after being cooled, is then introduced to the top tray of

Contactor Pressure PSIG	INLET GAS		OUTLET GAS	
	H_2S Grains/ 100 SCF	CO_2 Mol %	H_2S Grains/ 100 SCF	CO_2 Mol %
550	126	6.24	0.02	Less than 0.01
550	151	6.00	0.03	Less than 0.01
165	1,168	9.12	0.18	0
165	804	7.54	0.17	0
50	2,090	11.25	0.25	0
50	12,600	7.27	0.70	0
50	12,680	6.49	0.60	0

the contactor. As mentioned in the preceding paragraph, the top few trays of this contactor could actually be another small contactor operating at higher pressure.

Another cycle that may be employed has been described by McCartney[14] and is shown in Fig. 7. As above, the main solution treating stream might be a glycol-amine solution containing 15 to 20% water. In this case the small concentrated stream is kept separate from the more dilute treating stream by a chimney tray in the contactor, and passes through its own small exchangers, coolers, and reboiler, the vapors from the latter being discharged into the main treating section still. This cycle has an added advantage of substantially reducing vaporized amine losses from the plant. The monoethanolamine builds up to a certain extent in the concentrated solution, but most of it is vaporized in the small reboiler and returned to the main treating solution in the still. Again, the top section of the contactor could be a separate vessel operating at a higher pressure.

The use of a dilute glycol-amine solution in such cases has distinct economic benefits. For simultaneous treating and dehydration a glycol-amine solution containing approximately 5% water is used, but, where the job may be done more economically in two steps, or where purification only is desired, the more dilute solution may be used to advantage. The treating requirements set the tolerable amount of acid gas remaining in the lean solution, which then sets the required regeneration temperature, and this in turn sets the water content of the solution. The more dilute glycol-amine solution then has a lower viscosity which results in higher heat transfer rates. The regeneration temperature is less than that of the concentrated solution, thus reducing the heat load on the exchangers and decreasing the reboiler surface by increasing the mean temperature difference between the solution and the heating steam, or, if desired, permitting the use of lower pressure steam.

Typical solution compositions employed in the glycol-amine process may be comprised of from 10 to 30 percent monoethanolamine, 45 to 85 percent diethylene glycol, and 5 to 25 percent water. Table I shows data on purities obtained by glycol-amine solutions containing from 10 to 20 percent water. Higher purities than those shown can be reached economically by using glycol-amine solutions containing less water than indicated above.

No generalization can be made as to the most economical selection of one of the amine type processes to accomplish purification of a gas stream, or to obtain both purification and dehydration. However, an aqueous monoethanolamine solution can usually be used to advantage where the specifications for the treated residue gas are not stringent. This is particularly true of cases where the prime emphasis is on recovering CO_2 or H_2S for further use rather than on the purity of the treated gas.

But the advantages of the glycol-amine process become more prominent as the treating requirements become more rigid, principally because of the fact that glycol-amine solution may be stripped so completely and so readily of CO_2 and H_2S, especially the latter. However, as is always the case in comparison of two processes, advantages are associated with some disadvantages. A glycol-amine solution is subject to lower heat transfer rates than an aqueous amine solution because of its higher viscosity, necessitating more heat transfer surface, and the cost of the initial charge of diethylene glycol for the plant solution may prove to be a sizable item, even though the operating losses of this constituent are normally negligble. On the other hand, with an aqueous amine solution it is necessary to go to a more complicated two stream arrangement to meet some purity requirements and to save in operating utilities, necessitating additional equipment, and some purity specifications cannot be met economically by such a device.

Where dehydration is also required, the same comments apply as for purification only, and the choice is further complicated by the fact that more alternate schemes are available to accomplish the desired results. Separate plants, dilute and concentrated glycol-amine streams, or a concentrated glycol-amine stream with a low water content to obtain the results simultaneously might be the best answer. The choice would be dependent largely on the purity required in the treated gas and on the size of the required treating plant. However, if the necessary treating plant size is small, it is obviously most economical to obtain both results simultaneously, rather than use separate plants or separate streams, one for purification and one for dehydration.

The initial investment and operating costs of a purification plant

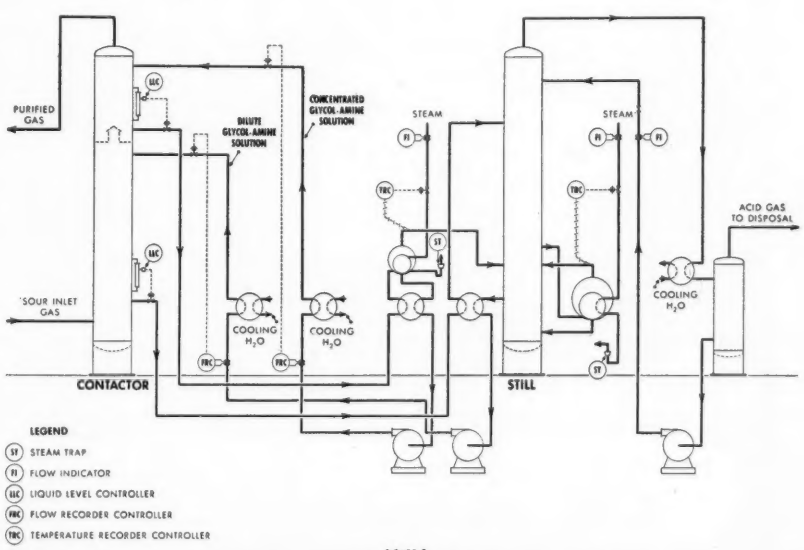

FIGURE 7

GLYCOL-AMINE SEPARATED TWO-STREAM CYCLE

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or of a purification and dehydration unit likewise are not subject to generalization. In addition to the size of the treating plant and the specifications for the treated gas, many other factors are involved, including the absorption pressure and the composition of the sour gas.

However, it is possible to quote approximate cost figures for typical plants. For example, a plant designed to purify and dehydrate, at pressures of 150 to 600 PSIG, 50 million SCF/Day of natural gas containing 2 percent total acid gas would require an initial investment, including utilities, of about $300,000. The direct operating costs for such a plant, including steam, power, solution losses, operating labor, supervision and maintenance would amount to about 2 mils per thousand SCF of gas treated. If the plant were to be amortized in five years, this would amount to a total cost of 5½ to 6 mils per thousand SCF of gas treated. The cost of a gas treating plant, per 1000 SCF/Day of gas treated, will vary inversely with the total quantity of gas to be treated, and directly with the operating pressure and acid gas content. Furthermore, it is obvious that operating labor, supervision and maintenance will be approximately the same for a small plant as for a large one. All the above applies equally to treating plants only and treating and dehydration plants for purification and dehydration. As mentioned earlier, no general selection of any process system can be made, and each treating problem must be considered individually.

The industrial application of the glycol-amine process is becoming increasingly important. To the best of the author's knowledge, utilization of this particular process first made it feasible to remove H_2S from gas by amine treatment with complete assurance that the residue gas would be sweet to the Bureau of Standards' lead acetate test[13]. This, in turn, led to the possibility of treating sour gas and transporting the purified gas to areas short of fuel and having high purity requirements regarding the H_2S content of the gas.

The outstanding example of this application is the project recently put in operation by the El Paso Natural Gas Company to transmit originally sour gas from the West Texas-New Mexico fields to Southern California. And at the same time this is undoubtedly the outstanding example of mass purification of sour natural gas, and more particularly of the large scale use of a single type treating process.

The project of the El Paso Natural Gas Company of transporting gas to California from the West Texas- New Mexico area is unique in the fact that the gas concerned originates in sour gas fields and must all be treated for hydrogen sulfide removal prior to transmission. The gases from the various fields being used contain considerable quantities of H_2S ranging up to more than 2 mol percent, while the CO_2 content is as high as 7 mol percent. The California requirement for the purity of the gas allows a maximum of 0.25 grains of H_2S per 100 standard cubic feet of gas, this content being equivalent to 0.0004 mol percent. The gas must naturally also be dehydrated to prevent any possibility of hydrate formation during transmission.

Such exact treatment as demanded by the California requirement for the purity of the gas necessitated the use of a process for purifying the gas that would be absolutely reliable, under continuous operation, in meeting the purity specification. As the treating step was such a critical part of the project, the El Paso Natural Gas Company focused considerable attention on the selection of the process that would assure its entire success, and decided that the glycol-amine process would provide the maximum assurance for meeting the high purity specification for the gas; in addition, the selection of this process solved the dehydration problem.

Prior to the initiation of proceedings to obtain permission to construct the pipeline to California, the El Paso Natural Gas Company had had some experience with the glycol-amine process. In the spring of 1945 they had started operation of a glycol-amine plant at Eunice, New Mexico. At that time this was the only suitable process they could find that would permit a guarantee to be made that the residue gas would be negative to the aforementioned Bureau of Standards lead acetate test. Subsequent operation of this plant and of two more glycol-amine plants near Jal, New Mexico, the Jal #1 and Jal #2 plants of the El Paso Natural Gas Company, proved the ease with which high purity gas could be obtained. So the El Paso Natural Gas Company was able to make the application for the California pipeline project with the knowledge that there was an existing process which would make it feasible and economical for them to remove H_2S from sour gases and transport the treated gas to an area with a fairly stringent purity specification. Approval of the construction of the California pipeline project enabled the El Paso Natural Gas Company to proceed with its plans. Sour residue gas from existing and building natural gasoline plants in the area and some sour gas from their own wells make up the predominant source of the entire gas volume.

Installation of glycol-amine treating plants was started at Eunice, New Mexico and at the Fullerton and Keystone fields, West Texas. It later became apparent that additional gas treating capacity would be required. Plans were made to dismantle the solution regeneration end of the existing plant at Eunice and move it to the Jal #1 plant where it would become a part of a new gas treating unit, while new regeneration equipment would be installed at Eunice to increase the treating capacity of the original glycol-amine plant at that location. With the completion of the above plants, the El Paso Natural Gas Company had a total of seven glycol-amine treating plants, including the previously existing Jal #1 and Jal #2 plants which remained unchanged.

All of the above plants, with one exception, are of the combination glycol-amine process wherein the gas is simultaneously purified and dehydrated. The solution employed is comprised of approximately 20 percent monoethanolamine, 75 percent diethylene glycol and 5 percent water. The one exception is the Keystone plant which utilizes the

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cycle described above in which dilute and concentrated glycol-amine streams are employed, with a small stream being taken off the main reboiler to a smaller reboiler for concentrating the solution, this concentrated solution then passing over the top few trays of the contactor.

The combined capacity of the above treating plants is approximately 418 million standard cubic feet per day of sour natural gas. The various plants are doing an excellent job of purifying the gas, and actual tests show that the H_2S content of the treated gas being transmitted through the California line is considerably less than the specified 0.25 grain per one hundred standard cubic feet. In addition, the dehydration obtained has been excellent, with not a single freeze-up occurring because of hydrate formation anywhere in the pipeline during the past severe winter.

The El Paso Natural Gas Company is now proceeding with necessary work and additions to increase the capacity of the California pipeline. Involved in this project is additional gas treating capacity, so that the capacity of the Keystone plant is being susbtantially increased, while new plants are to be built at the Goldsmith and Wasson fields, both in West Texas. The first of these two new plants is another employing the combination glycol-amine solution for simultaneous purification and dehydration, while the latter plant will embody a flow scheme as shown in Fig. 7, with the gas being treated by a dilute glycol-amine solution at a lower pressure and the dehydration step taking place in a separate smaller contactor operating at a higher final pressure.

After the Goldsmith and Wasson plants and the Keystone extension are completed, the El Paso Natural Gas Company will have combined capacity to treat 612 million standard cubic feet per day of sour natural gas to a high purity such that the gas will be suitable for domestic use in an area having a rigid requirement for the maximum H_2S content of the gas. Their enterprise in applying large scale treating operations has aided materially in the conservation and economic utilization of a hitherto wasted important natural resource.

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Washington Office of the Independent Petroleum Association of America calls attention to an Associated Press account appearing in the Fort Worth Star-Telegram. "Kilgore—Ray O. Armstrong said Thursday he quit the post as chairman of the Federal Petroleum Board because 'the Government has too many employees who are not needed, and I am one of them.' "The Kilgore oil man, chairman since 1945 and a board member since 1940, said Interior Secretary Krug has accepted his resignation."

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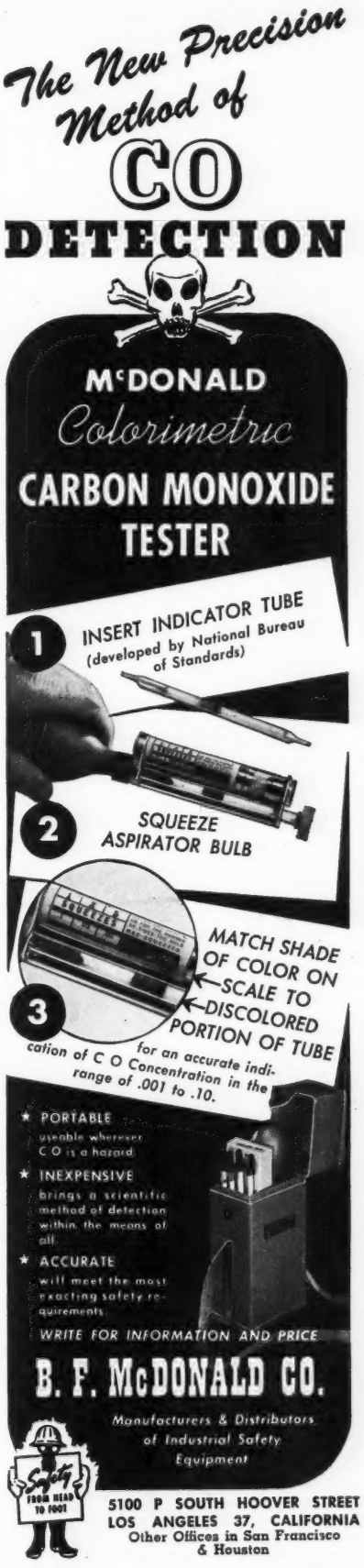
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Some Limitations of Rod Pumping

ABSTRACT:

The author discusses rod fall, and the strengths of sucker rods, tubing, pumping units, and the pumps as they affect the amount of fluid that can be pumped from any depth. Curves showing quantitatively those limitations of the sucker rod pumping system are presented. A few examples of actual pumping performance are given.

It is concluded that the amount of fluid that can be pumped from depths less than 1700 feet is limited by the speed of rod fall. The amount that can be pumped from greater depths is limited by the working strength of sucker rods. The development of 40,000 p.s.i. working stress rods has made possible a large increase in the amount that can be pumped from below 9,000 feet.

INTRODUCTION:

In view of the increasing depths of the wells that are ceasing natural flow, and the present demand for maximum production, it is probably not out of place to discuss what can and cannot be produced by means of sucker rod pumping. This paper discusses the limitation inherent in this method of producing because of rod fall, and the limitations placed upon the pumping system by the present strengths of sucker rods, tubing, pumps and pumping units.

Throughout the paper an attempt is made to confine assumptions so they are in accord with common practice in California. The possibilities in the use of rods smaller than ¾ inch, or larger than 1 inch, are not covered, as these rods are not commonly used in California. Similarly, no mention is made of the possibilities from stroke lengths greater than 240 inches or plunger sizes of more than 4¾ inches.

ROD FALL:

There is a definite speed for any particular pumping installation at which the carrier bar and polished rod clamp will just stay in contact on the downstroke; at greater speeds the rods will not fall as fast as the carrier bar. Because rods will not operate in compression satisfactorily, the speed at which the system can operate is limited by the rate at which the rods and plunger will fall by gravity to the bottom of the stroke.

By
Kenneth T. McCamman
Shell Oil Co., Inc., Bakersfield, Calif.

The Author

If the rods and plunger were falling freely in a vacuum, they would be accelerated by gravity at 32 feet per second per second. If the rods would accelerate uniformly at this rate for the first one-half of the downstroke, and if the first one-half of the downstroke took one-fourth of the time of a complete cycle, the laws of freely falling bodies would indicate that pumping could be done at, for example, 36-66 inch strokes per minute, or at 27-120 inch strokes per minute. Actually the motion of the rods and plunger is opposed, principally, by friction around the rods and in the pump, and a unit cannot be operated this fast satisfactorily. Several wells that were run at the speed at which the polished rod clamp and carrier bar started separating, indicated that the practical limit on speed is about seventy-five per cent of the speed determined for a freely falling body, or for example, approximately 27-66 inch strokes per minute, or 20-120 inch strokes per minute.

Figure 1 shows production rate against depth as limited by rod fall for these two speeds and stroke lengths. Production rates were computed by assuming that the fluid was water; rod string was all 1 inch; volumetric efficiency of the pump was 80%; tubing was anchored; and the maximum size plunger available was 4¾ inch. The optimum plunger size was used and the plunger overtravel and rod stretch were taken into consideration.[1]

It is interesting to note that at all depths the longer stroke length permits a higher production rate, although the shorter stroke length is run at a faster speed. This is due to the fact that the plunger accelerates for approximately one-half the stroke length; the longer stroke therefore can have a faster maximum and average speed, and a greater displacement.

ROD STRING:

In computing the limitation the working strength of the rod string places upon rod pumping it is necessary to have an expression for the maximum stress developed in the rods and to know what stress present day rods will stand. In this paper the Mills formula[2] is used to compute maximum stress. This formula is a simplified expression for an extremely complicated problem. It does give, in general, reasonably accurate results. It makes no allowance for the possibility of the reflected loads in the rod string being in phase with the imposed loads[3]; when this occurs the maximum stress indicated by the Mills formula may be appreciably exceeded. It is considered good practice to select the speed of a heavily loaded rod string so that reflected and imposed loads are out of phase.

Conventional alloy steel rods normally give satisfactory service at maximum stresses up to 30,000 p.s.i. In non-corrosive wells, particularly when maximum and minimum rods stresses are not too widely different, satisfactory service is obtained at stresses up to 34,000 p.s.i. In corrosive wells, or where the minimum rods stress is fairly low, satisfactory service is limited to less than 26,000 p.s.i.

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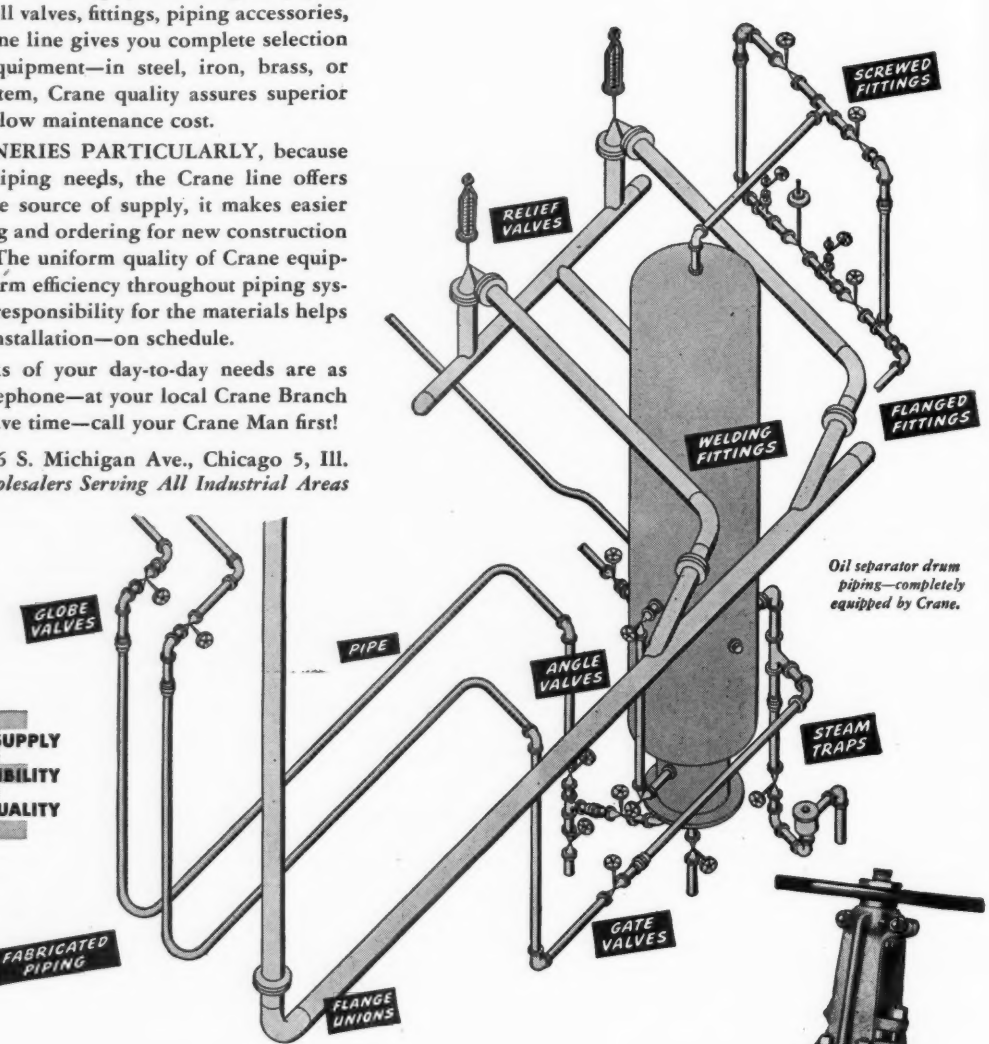

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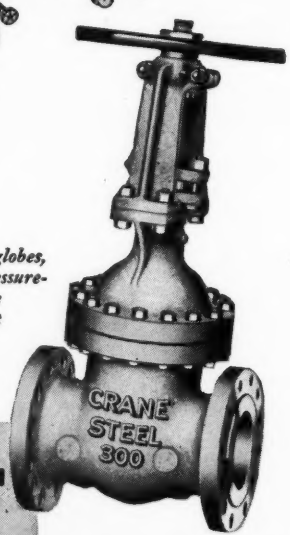

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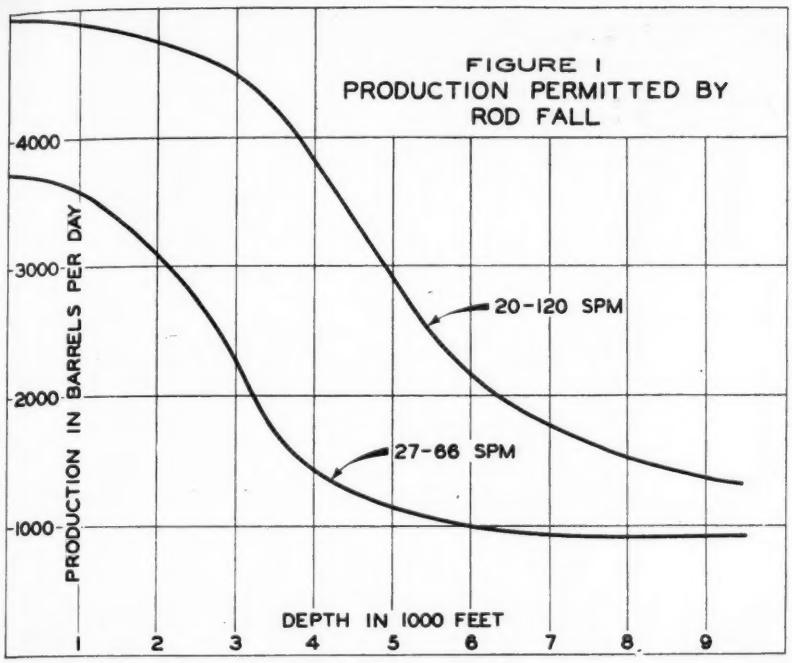


Somewhat over a year ago several rod manufacturers placed on the market, for test, new rods of a higher strength steel. From the result of laboratory corrosion fatigue tests, these rods should withstand maximum operating stresses up to 40,000 p.s.i. They are still undergoing field tests, and while they have not fully proved themselves, results to date indicate that they probably will give good service at stresses up to 40,000 p.s.i. under favorable conditions.

A 9300-foot string of rods of uniform size hanging freely in water has a stress of 30,000 p.s.i. in the top rod. As this stress would increase if the rod string were moved, or if a plunger on the bottom of the string were supporting any fluid weight, it is obvious that uniform size strings of rods are not adapted to deep wells. In practice, strings over 5000 feet long are composed normally of two or three sizes, the length of each size being selected to give approximately equal stress in the top rod of each size.

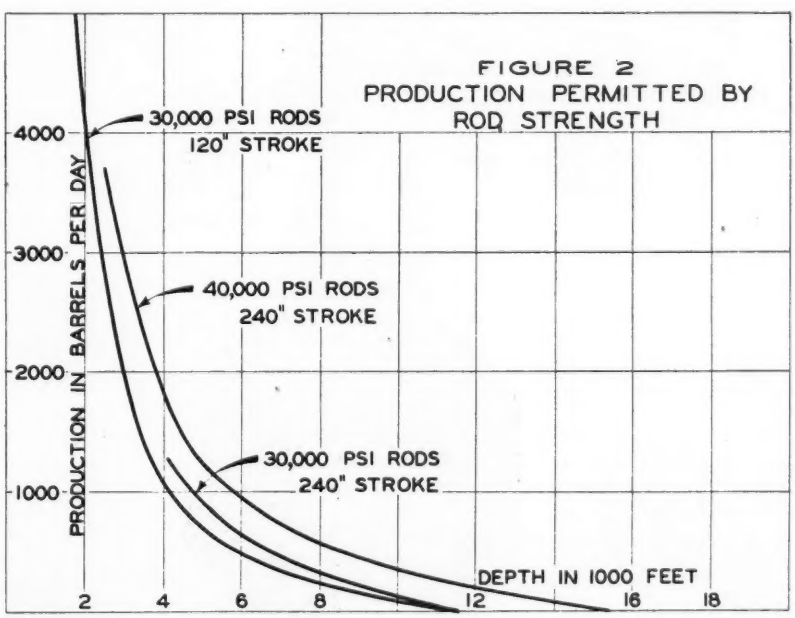
Figure 2 was computed to show the limitations placed upon production by working strength of the rod string. The three curves show production possible with a 120-inch stroke and rods stressed to 30,000 p.si.; with a 240-inch stroke and rods stressed to 30,000 p.s.i.; and with a 240-inch stroke and rods stressed to 40,000 p.s.i. Production rates were computed by assuming that the tubing was anchored; possible plunger sizes were from 1 inch to 4¾ inch; volumetric pump efficiency was 80%; the rod string was composed of 1 inch rods at depths of 5000 feet or less; and the rod string was properly tapered using 1 inch, ⅞ inch, and ¾ inch rods at depths of over 5000 feet.

It is interesting to note that pumping cannot be done from below about 11,500 feet with rods stressed to 30,000 p.s.i. regardless of stroke length, while it can be done from about 15,500 feet with rods stressed to 40,000 p.s.i. At these depths rod weight and fluid weight, without any acceleration load, develops these maximum stresses in the rods. The development of 40,000 p.s.i. working strength rods, assuming that it is being satisfactorily accomplished, has thus not only permitted a large increase in the amount that can be pumped in the depth range of 9000 to 11,000 feet but has opened the possibility of pumping from several thousand feet deeper.

TUBING STRENGTH:

Tubing used in rod pumping is subjected to two types of loading that could cause failure; the pressure of the fluid it contains might burst it; or the weight it supports might pull it in two.

In normal pumping and well pulling operations the maximum internal pressure applied to the tubing will approximate the static pressure of a column of water of the same length as the tubing. Grade N80 external upset tubing, 2½ inch nominal diameter, will withstand a minimum internal pressure of 10,570 p.s.i.[4] Allowing a safety factor of 1.5, it can be considered to be strong enough to withstand an operating pressure of 7030 p.s.i., which is the hydrostatic head at 16,300 feet. Other sizes of N80 tubing are of



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approximately the same strength. Tubing then, as far as bursting strength is concerned, permits pumping from about 16,000 feet.

In normal operations the maximum weight is placed upon tubing during a stripping job, when the pump is sanded up or otherwise stuck. Under these conditions the load on the tubing will approach the sum of its own weight, the weight of the fluid it contains, the weight of the rod string, and the force required to release the tubing anchor. Grade N80, 2½ inch, external upset tubing has a minimum yield strength in tension of 144,960 pounds. The tubing weighs 6.5 pounds per foot, and the rods and fluid it contains weigh approximately 3.6 pounds per foot. It is, therefore, subjected to a load of 10.1 pounds per foot plus the indeterminate load required to free the tubing anchor. Allowing a safety factor of 1.25 on minimum yield strength (which is believed sufficient to cover the normal additional load imposed by the anchor) its safe operating depth, as limited by tension, can be considered to be

$$\frac{144{,}960}{1.25 \times 10.1}$$

or 11,500 feet. Other sizes of N80 tubing have approximately the same strength to weight ratio, and can be used to comparable depths.

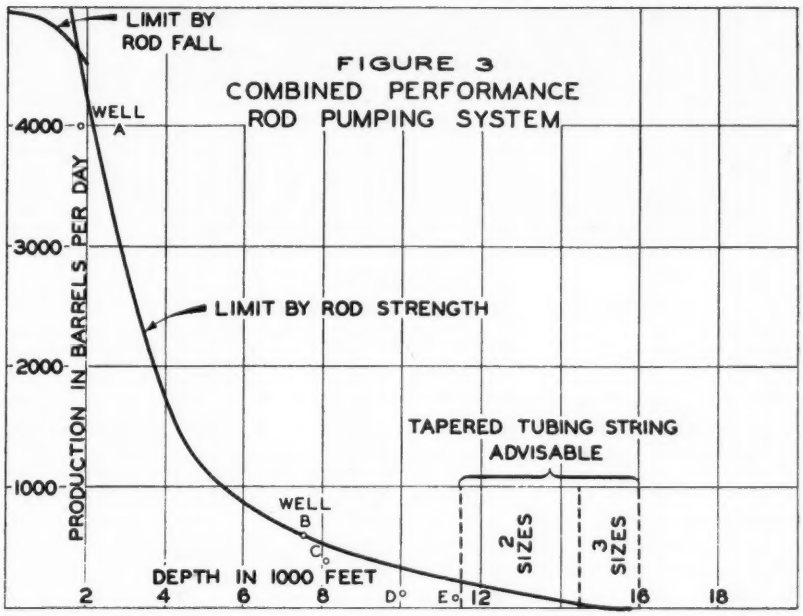
When it is necessary to pump from depths greater than 11,500 feet, a tapered string consisting of two or more sizes of tubing should be used. For example, a tapered string of 2½ and 2 inch at 14,500 feet, or of 3, 2½ and 2 inch at 17,900 feet, has a safety factor of approximately 1.25 during a stripping job.

Present day tubing, therefore, permits pumping from as deep as 16,000 feet if the casing size allows use of a properly tapered string. This is about 500 feet deeper than rods can operate; consequently tubing strength is not a major limitation of rod pumping.

PUMPING UNIT:

One rather large pumping unit has the following specifications:

Maximum stroke .... 120 inches
A.P.I. beam rating. 33,900 pounds
Gear rating .....850,000 inch-pounds peak torque
Maximum counter balance 24,300 pounds (at 120 inch stroke)



The beam strength of this unit will permit stressing a 1 inch rod to 43,200 p.s.i. or some 3200 p.s.i. in excess of the maximum recommended stress of the best rods now available.

A.P.I. Standards 11-4, August 1941, states that the gear rating required of a unit shall be either fourtenths of the maximum polished rod load times one-half the stroke length; or the maximum polished rod load minus the counter balance, times one-half the stroke length; whichever is larger. By this criterion the above unit requires a gear box rating of only 754,000 inch-pounds to stress a 1-inch rod to 40,000 p.s.i. As the gear box rating exceeds this figure it is apparent that it has ample strength to develop full performance from 1 inch or smaller rods.

A large hydraulically operated pumping unit is rated at 35,000 pounds maximum polished rod load and is capable of a 240-inch stroke. It cannot be considered a general purpose unit, as its maximum speed is only about 7 strokes per minute, and it is satisfactory at that speed only if the minimum and maximum polished rod loads are reasonably close and the horse power requirements, therefore, not extreme. In deep pumping, where the major part of the load is rod weight, this condition is met; 7 strokes per minute is a satisfactory speed; and the unit is capable of stressing rods to over 40,000 p.s.i.

Present day units, therefore, are capable of stressing rods to more than their operating strength. Consequently, they are not a major limitation on the amount of fluid that can be pumped.

PUMPS:

It is believed that the depth at which a pump can operate is limited by the working strength of the smallest cross-section of steel between the rods and the plunger. In a 1¼-inch plunger pump this smallest cross-section is .27 square inches. If it were pumping water from 16,000 feet the fluid load on the plunger would be about 5,850 pounds and the stress in the critical section would be about 21,600 p.s.i. This is well within the endurance limit of this quality steel, hence the pump, as far as is known, should operate satisfactorily.

COMBINED PERFORMANCE:

The curve on Figure 3, which is composed of parts of the curves of Figures 1 and 2, illustrates what may be considered the maximum amount of fluid that can be pumped from any depth. The curve is based upon the preceding assumptions and computations. Rod fall is the limiting factor above 1700 feet; rod strength is the limiting factor below that depth.

Also plotted on Figure 3 are examples of actual production rates attained by rod pumping. All of the wells, with the possible exception of Well A, were believed pumped down at the given production rates. Pertinent production information on the pumping installations follows as Table I.

Fruitvale Try Running Liner

Le Bow and McNee are running liner in KCL-Stockdale No. 3 in Sec. 34-29s-27e in the Fruitvale area. The project, a Western Gulf abandonment, was redrilled from 4257 to 4402 ft.

TABLE I
EXAMPLES OF ACTUAL PRODUCTION

Well No.	Field (California)	Plunger Size (inches)	Shoe Depth (feet)	Speed (SPM)	Stroke (inches)	Prod. (B/D)
A	Gato Ridge	5¾	1,780	18	102	4000
B	Santa Fe Springs	2	7,420	7.6	180	600
C	Kettleman Hills	2¼	8,067	5	240	400
D	Buena Park	1¼	10,002	11.6	102	135
E	Greeley	1¼	11,341	4.5	240	95

CONCLUSIONS:

The speed with which rods and plunger will fall limits production from depths less than about 1,700 feet.

The operating strength of sucker rods is the primary limiting factor on production from depths over 1700 feet. Tubing, pumping units and pumps appear sufficiently strong to permit full utilization of the working strength of rods.

The development of 40,000 p.s.i. working strength rods, which now seems assured, has more than doubled the productive capacity of the rod pumping system from depths below 9000 feet, and has lowered the limiting depth of rod type equipment to approximately 15,000 feet.

References

[1]Throughout this paper, plunger over-travel and rod stretch were computed from the following formulas:

$$\text{Over-travel in inches} = 1.55\ L^2 \times \frac{SN^2}{70500}$$

where: L = Depth in 1000 feet
S = Polished rod stroke in inches
N = Number of strokes per minute

$$\text{Rod stretch in inches} = .0001793\ Ap\ L \frac{L_1}{Ar_1} + \frac{L_2}{Ar_2} + \frac{L_3}{Ar_3}$$

where: L = Depth in 1000 feet
Ap = Area of plunger in square inches
L_1, L_2, L_3 = Length in feet of rods having areas of Ar_1, Ar_2, Ar_3, square inches respectively.

These formulas were taken from "Instructions for Using the Axelson Slide Rule" published by the Axelson Manufacturing Company.

[2]The Mills formula, presented in Production Bulletin 230, API, 1943, pg. 442, is:

$$Wmax = Wo + Wr \frac{1 + SN^2}{70500}$$

where: Wmax = Maximum polished rod load, in pounds.
Wo = Fluid weight on net plunger area, in pounds. Fluid assumed to have weight of water.
Wr = Weight of rods in air, in pounds.
S = Polished rod stroke in inches.
N = Number of strokes per minute.

[3]J. C. Slonnegar in "Drilling and Production Practice," API, 1937, pg. 179, showed that reflected and imposed loads are in phase when 237,000, divided by the product of the length of the rod string in feet and the number of strokes per minute, is a whole number.

[4]The strength and weight data on tubing was obtained from Supplement 3, July 1947, to 3rd Edition of API code 5-0-2.

This paper was presented at the Spring Meeting of the Pacific Coast District, Division of Production, API, Biltmore Hotel, Los Angeles.

June Meeting, Pacific Coast Section of the Society of Exploration Geophysicists

The summer meeting of the Pacific Coast Section of th S.E.G. convened at the El Tejon Hotel, Bakersfield, on June 18, 1948 for an afternoon symposium, a dinner, and an evening meeting.

The afternoon session was devoted to a symposium on "Location of Faults by Geophysical Methods," with the meeting opened to general discussion after each speaker. Two paper were read by their authors:

Mason Hill, Richfield Oil Corp., "Faults—Their Character, Classification and Importance."

Miller Quarlel, Jr., United Geophysical Co., "Fault Interpretation in Southwest Texas."

Prepared short reports were also given by:

R. C. Dunlap, Geophysical Service Inc.; Dean Walling, Western Geophysical Co.; William N. Booth, Consultant; O. F. Van Beveren, Standard Oil Co. of Calif.; N. F. Lea, The Texas Co.

After dinner Herbert Hoover, Jr., President, United Geophysical Co., spoke on "Exploratory and Economic Aspects of the Oil Development in Alaska."

McKinney Elected President PESA

At the Thirteenth Annual Meeting of the Petroleum Equipment Suppliers Association Mr. A. W. McKinney, Vice President of The National Supply Company was elected President of the Association.

It was also announced that the next annual meeting would be held at White Sulphur Springs, Virginia.

Just before adjournment the Association passed a resolution suggesting that the International Petroleum Exposition be held every four years.

Marking the final luncheon meeting before the summer recess, the Pacific Coast section of the American Association of Petroleum Geologists convened at the Clark Hotel in Los Angeles. Earl Noble, Bill Winham and Gordon Bell reviewed events at the recent national convention of the association in Denver.

With Drilling Contractors

American Association of Oilwell Drilling Contractors has announced that the drilling mud control classes, sponsored by the organization at the Bakersfield Evening High School, will be adjourned during the summer. According to W. F. (Frank) Jones, secretary of the California chapter of the association, classes will be resumed in September. Application for enrollment should be addressed to the secretary at 404 Halliburton Building, 1709 West 8th Street, Los Angeles 14.

Dallas headquarters of the AAODC has announced dates for three important meetings. The top gathering of the year—Eighth Annual Convention—has been set for October 11-13 at Houston. Headquarters for the three-day meeting will be at the Rice Hotel. Reservations are being handled by a committee headed by Howard Phifer, L. D. Cain Drilling Co., 1117 City National Bank Building, Houston. The third annual drilling industry safety clinic is planned for July 6-7 at the Baker Hotel in Dallas. Reservations are in charge of J. Doyle Settle, association secretary, 1412 Gulf States Building, Dallas. Association directors will hold their third quarterly conclave July 13 at the Brown Palace Hotel at Denver.

Douglas H. Graham, vice president of the AAODC for California, Long Beach contract driller and producer, has been named to the board of directors of the Children's Home Society of California. A resident of Long Beach since 1922, the oil executive has been long identified with civic and philanthropic enterprises. He is a member of the Rotary Club and president of the Long Beach council of the Children's Home Society, the Assistance League, the Los Cerritos PTA and many other groups.

Los Angeles visitors recently were General Joao C. Baretto and staff of the Conselho Nacional do Petroleo, a department of the Government of Brazil. The staff included Doctors Leopoldo Mituez de Mello, C. E. Paes Baretto, Pedro de Moura, Antonio Seabra Moggi and Romeu Maraguez. During their stay in Southern California they were the guests of Ralph Marshall, vice president of Drilling and Exploration Co. Highlight of the visit of the South American oil men was a reception at the California Club, Los Angeles. Drilling and Exploration is drilling a number of wells on contract in the Bahai area in Brazil for Conselho Nacional.

E. C. (Ned) Brown, president of Brown Drilling Co. at Long Beach, attended the International Petroleum Exposition and Congress at Tulsa on his way back to the Pacific Coast from New York. Forrest and Joe Kellogg of Kellogg & Sons also were in attendance at the exposition.

W. W. Duncan, the new safety director for Loffland Bros. Co., was previously safety engineer with Insurers Indemnity & Insurance Co. at Tulsa.

Camay Drilling Co. has contracts to drill Adams-Aguirre No. 106 for Southern California Petroleum Corp. in the Ramona field, and Huntington No. B-119 for Standard of California in the Huntington Beach field.

Pioneer Drilling Co. has been assigned contract to redrill Harbor No. C-25 for Hancock Oil Co. in the Long Beach Harbor field.

Shell Oil Co. is understood planning to contract the drilling of Alamitos No. 50, another 10,000-ft test well at Long Beach.

Contract has been awarded to San Joaquin Drilling Co. to drill Larrey No. 7-14 for R. E. Havenstrite in the Riverdale field.

Santa Fe Drilling Co. is redrilling Stearns No. 62 for Union Oil Co. at Brea-Olinda.

Total domestic drilling was approximately 18,500,000 feet per year below that needed during the four war years from 1942 to 1945 to provide the country with normal additions to underground crude oil reserves. One-quarter of the deficiency during 1942-1945 probably will be made up this year and in 1949. The current year's drilling program calls for the drilling of 37,000 wells and 130,500,000 feet of hole and in 1949 a goal will set on 38,300 wells and 134,000,000 feet.

Thomas P. Pike Drilling Co. is using one of the largest mobile rigs in California fields. It is an IDECO Rambler No. H-40.

Newhall Lease Scene

Humble Oil & Refining Co. of Houston, one of the world's largest producing and refining organizations, has leased approximately 620 acres of the Los Angeles County Honor Farm in the Newhall area. The county property was tested some years ago by Barnsdall Oil Co. The initial try found showings but they evidently were below commercial worth. A second hole found nothing. Drilling was not too easy due to steep dips of the formations.

Seal Beach Try Sets Pipe

Marine Exploration Co.'s State No. 2 well in Sec. 11-5s-12w offshore South Seal Beach is preparing to run 9⅝-in. casing to set at a point above present bottom at 7500 ft.

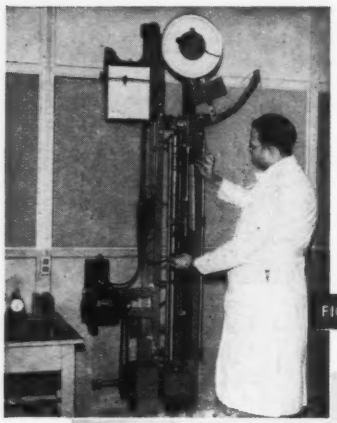


FIG. 1

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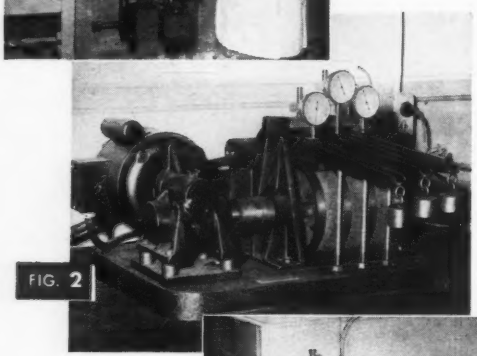

FIG. 2

FIG. 1 A sample of rubber, molded and cut to one thousandth of an inch tolerance, is stretched on this special tensile testing machine. The amount of stretch, ultimate tensile strength, modulus, and tear resistance are determined to insure that the rubber has the strength to do the job for which it is intended.

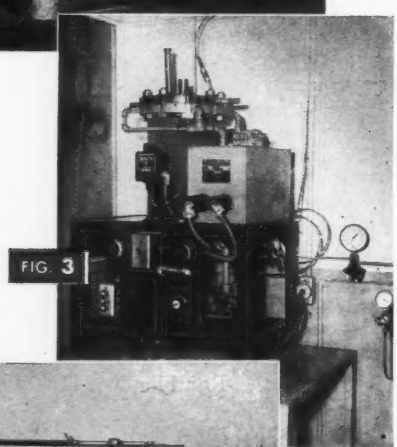

FIG. 3

FIG. 2 We know that Patterson-Ballagh rubber is going to give you long service, even under abrasive conditions. Rubber samples are placed in this abrasion testing machine to determine abrasion resistance. Each batch of rubber must conform to standards set by 21 years' experience in the manufacture of Casing Protectors.

FIG. 3 In this oxygen pressure aging equipment, the equivalent of several years' aging is completed in several hours. Rubber samples are also subjected to a high temperature over specified periods. The samples are tested and inspected for changes in physical properties. Patterson-Ballagh Oil Field Specialties keep their elasticity and other properties when in stock or not in use in the field.

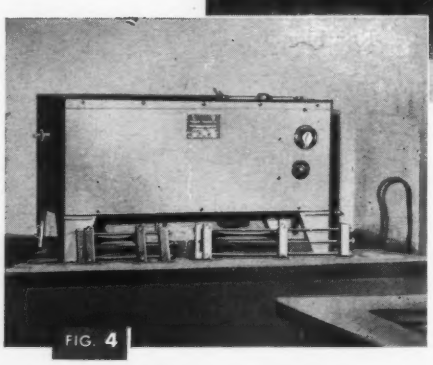

FIG. 4

FIG. 4 Simulating actual operating conditions, this oil bath determines the resistance of rubber to hot oil. The rubber samples are immersed in the bath under various conditions and then subjected to exhaustive tests. Tests such as the above make Patterson-Ballagh the leader in the manufacture of oil-resistant rubber for Oil Field Specialties.

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Field Development

PREPARED FROM CALIFORNIA OIL WORLD NEWS SERVICE

Los Angeles Basin

Inglewood Well Flows

Federal Oil Co. has completed a good well at Inglewood. It is Culver City Comm. No. 1 in Sec. 7-2s-14w, which came in from 8462 ft. for a yield of 480 barrels of oil and 300,000 cubic ft. of gas a day.

Dominguez Well Drills

In the Dominguez field, Union Oil Co. is digging at 7110 ft. with Morton & Sons-Union-Del Amo No. 1 in Sec. 3-4s-13w. The company's Callender No. 113 is coring at 9715 ft. on Sec. 32-3s-13w.

West Newport Wells Deeper

In the West Newport area, Amerada Petroleum is drilling at 5079 ft. with Lamb No. 68-6 on Sec. 6-6s-10w. Pacific Western has reached 3466 ft. by drilling Gisler No. 2 on Sec. 18-6s-10w. Rawe-Berger & Associates' Signal-Deeble No. 5 in the same section was abandoned at 1483 ft.

Potrero Well Digs

Basin Oil Co. is drilling on down at a depth of 10,265 ft. with its Inglewood Comm. No. 1-1A in Sec. 28-2s-14w. Inglewood Comm. No. 7-1 in the section is fishing after redrilling to 9506 ft. Total depth is 11,123 ft.

Desert Try Drills Ahead

At Palmdale in the Antelope Valley area, Antelope Valley Development Co. is drilling gray sand at 3982 ft. in Del Sur No. 1 on Sec. 28-7n-13w, Los Angeles County. The project is about 70 miles from metropolitan Los Angeles.

Long Beach Well Works

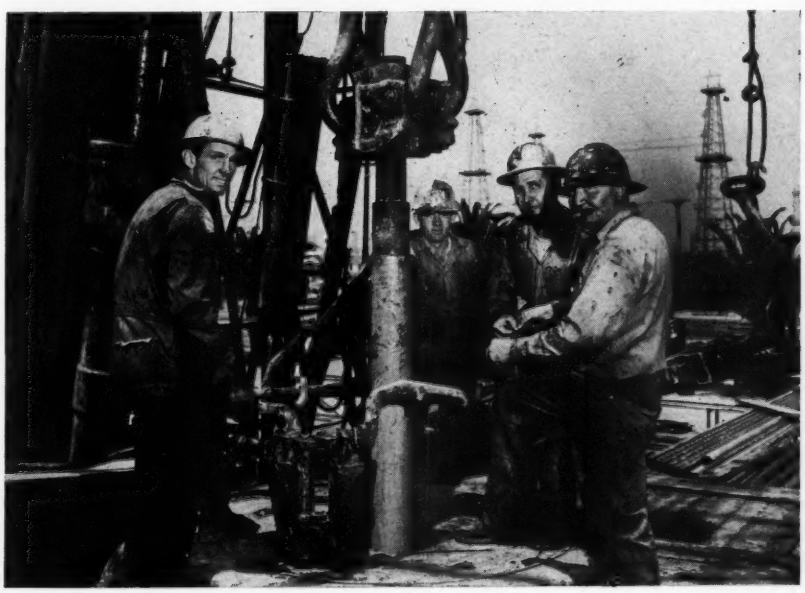
Cleaned out to 9553 ft. Pacific Western Oil Corp. is preparing to gun perforate at intervals from 7285 ft. to 9487 ft. in its Hilton-Stanton No. 1 in Sec. 29-4s-12w at Long Beach. Total depth is 10,527 ft.

Elsmere Try Flows

Nelson-Phillips Oil Co. has completed Kraft No. 2 in Sec. 31-4n-15w in the Elsmere area near Placerita Creek at 782 ft. for a flow of 80 barrels a day. The Swall-Ferrier No. 1 in the section drilled to 502 ft. and was abandoned. The hole apparently crossed a fault into fresh water. Location for Swall-Ferrier No. 2 has been staked 1170 ft. north and 1000 ft. west of the southeast corner of the same section. Kraft No. 3 is rigging up. Indian Oil's Wanda-Kraft No. 1 in the discovery section is drilling at 450 ft.

Olive Wildcat Drills Shortly

In the Olive area in Orange County, Standard of California has made location for Taft Comm. No. 1 in Sec. 20-4s-9w. The company's Lomita Land & Water Company No. 3-1 in Sec. 19-5s-11w at Sunset Beach is spot coring below 8000 ft. C.S.O. Fee No. 101 in Sec. 2-3n-17w



In the Wilmington Field, Long Beach Oil Development Co.'s Well No. C-48, Acme Drilling Co., contractors. Left to right: L. F. Morrison, cat head; C. H. Canada, lead tong; M. P. Shiflet, pipe racker, J. E. Thornburgh, driller.

in the Pico Canyon area is drilling at 1017 ft. Frew No. 1 is drilling at 4984 ft. in Sec. 29-3n-16w at Aliso Canyon.

Whittier Try Scene

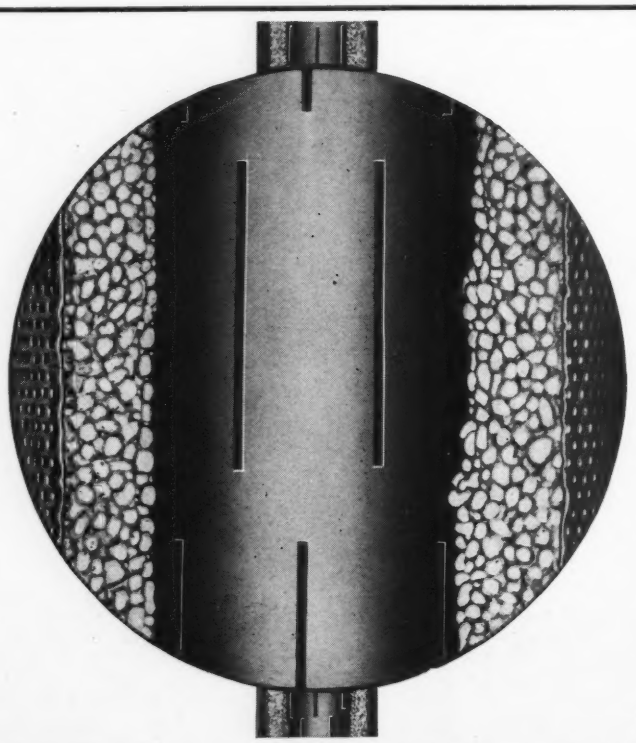
Union Oil and Fullerton Oil have joined forces to drill a joint test in the Whittier area. It will be known as Mineral Springs No. 3 and prospect in Sec. 25-2s-11w. Shepard-Pendleton's Hillside No. 1 in Sec. 22-2s-11w is drilling at 665 ft.

Placentia Test Cores

Near Placentia, Universal Consolidated Oil Co. is coring shale at 6605 ft. in Wiley No. 1 wildcat in Sec. 5-4s-9w, Orange County.

Chino Test Hits Oil Sand

With hole bottomed presently at 699 ft. in oil sand, Mercury Oil Co. is running casing in its No. 1 wildcat in Sec. 32-2s-8w in the Chino Hills in San Bernardino County. Chino Hills Oil Co.'s Chino Hills No. KB-4 in Sec. 33-2s-8w is coring at 1882 ft.



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Oceanside Project Digs

Prospect drilling is making headway at 1835 ft. in Charles F. Holmes No. 1 wildcat in Sec. 31-11s-4w near Oceanside, San Diego County.

Puente Try Spuds

Spudded and drilling at 250 ft. is the last report from Louis H. Didier's Wilson Ranch-Didier No. 1 exploratory venture in Sec. 19-2s-9w in the Puente area, 20 miles east of Los Angeles.

Athens Area Active Center

On the Union-Poindexter lease, Shell Oil Co. is drilling at 8209 ft. with No. 3 in Sec. 12-3s-14w at Athens. Pacific Western Oil Corp. is grading for Howard Park Comm. No. 1 in the section. A new producer in the area is Union Oil's Howard Park No. 40 in Sec. 18-3s-13w. It started off on the pump from 5786 ft. at the rate of 80 barrels a day, cutting 44 per cent.

Beach Well Rigging Up

S. M. B. Oil Co., headed by S. M. Brooks, is rigging up to drill Martin No. 1 in Sec. 10-6s-11w at Huntington Beach. Skeen and Brinkerhoff is ready to start work on No. 1 well on 21st street between Palm and Acacia avenue at the beach city field.

Lawndale Developing

Seaboard Oil Co.'s Johnson No. 4 in Sec. 17-3s-14w, seeking deep zone production at Lawndale, is drilling ahead below 1700 ft. Seaboard Comm. No. 5-1, No. 7-1 and No. 8-1 are locations in Sec. 20-3s-14w. In Sec. 21-3s-14w, General Petroleum is drilling at 7860 ft. with Powell No. 1. Barnsdall Oil Co. is ready to drill Elizabeth Smith No. 1 in Sec. 21-3s-14w. A technical spud has been made.

Coastal and Northern District

Santa Maria Active Field

Development work in the Santa Maria Valley field is punctuated by completion of another well. The new completion is Union Oil Co.'s O'Donnell No. 2-14 in Sec. 20-10n-34w, which came in from 5650 ft., pumping 93 barrels in 21 hours and cutting 44.2 per cent. Bradley Lands No. 2-19 in Sec. 36-10n-34w is drilling below 3400 ft. Pacific Western's Carranza No. 5 in Sec. 28-10-34w is drilling at 4388 ft. Richard & Rowan has made location for No. 1 in Sec. 19-10n-33w.

So. Mountain Well Completed

Texas Company has successfully completed S. P. No. 42 in Sec. 18-3n-20w at South Mountain for 85 barrels of 26.7 gravity oil daily from 5085 ft. S. P. No. 44 in the section is drilling at 3588 ft. and bothered somewhat by circulation trouble.

Padre Canyon Well Flowing

In the Padre Canyon field in Ventura County, General Petroleum Corp. has completed Padre No. 12 in Sec. 15-3n-24w. The project started off from 3610 ft. flowing 318 barrels of 30 gravity oil through a 16/64-in. bean. Cut was 0.6 per cent.

San Ardo Try Going On Pump

Jergins Oil and North American Oil Consolidated are preparing to run 3-in. tubing and pump in Orradre No. 15-12 in Sec. 12-23s-10e at San Ardo in Monterey County. The well, drilled to a total depth of 2157 ft., swabbed clean oil to 900 ft., but would not flow. Gravity of the crude is somewhat heavy and, while the well was not disposed to flow, an excellent pumper is indicated. The combination's Ferrini No. 73-11 test in Sec. 11-23s-10e is rigging up. Hamby No. 1 is a location in Sec. 18-23s-11e. Standard of California is adding to its acreage holdings in the area.

Afton Try Digs

Richfield Oil's Afton Community No. 1 in Sec. 2-18n-1w in the Afton area of Glenn County is down 537 feet and ready to run surface casing.

Solano County Gas Test Spuds

Standard of California has spudded and at last reports was drilling ahead at 460 ft. with Kirby Community No. 6 gas test in Sec. 13-4n-1w, Potrero Hills, Solano County.

Kirby Hills Well Testing

Shell Oil is continuing to test uphole by stages its Harper No. 1 gas explorer in Sec. 14-4n-1w at Kirby Hills in Solano County. Total depth is 7500 ft., with casing set on bottom.

Casmalia Adds Try

Union Oil Co. is starting Jesus Maria No. 1, an exploratory hole southwest of the Casmalia field in projected Section 28-9n-35w, Santa Barbara County. The company's Escolle No. A-3 in the section is ready to go on the pump. Total depth is 2840 ft., with casing cemented at 2248 feet. Crandall-Government No. 1 test in Sec. 11-7n-33w at East Lompoc has been abandoned at 4931 ft. A followup job, Santa Rita No. 1, will drill in Sec. 12-7n-33w. Wickenden No. 2-28 wildcat at Olivera Canyon in Sec. 28-9n-32w is making hole ahead at 3783 ft. South of King City in Monterey County, Union is prospecting ahead at 1611 ft. with Keans No. 1 in Sec. 8-22s-8e.

Zaca Adds Production

Tide Water Associated Oil's Luton No. 93 in Sec. 29-8n-31w in the Zaca area, which started off at the rate of 210 barrels daily from a finishing depth of 5315 ft. at last reports was making 90 barrels a day and cutting 17 per cent. Chamberlin No. 22 in Sec. 33-8n-31w is washing perforation. Total depth is 5340 ft. Davis No. 24 in the section is drilling at 2473 ft.

Conejo Try Drills Ahead

Ti-Bell Drilling and Roy, Inc., is drilling deeper at 7001 ft. with Janss No. 1 wildcat in Sec. 33-2n-19w in the Conejo area, Ventura County.

Richfield Oil Corp.'s well No. A-93 in the Wilmington field, Loffland Bros., contractors. Rear row, left to right: J. H. White, cat head; Larry McCombs, driller; Charlie Thatcher, lead tong; kneeling in front, R. C. Hill, pipe racker.

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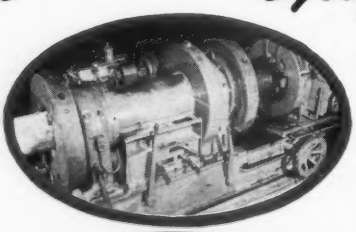

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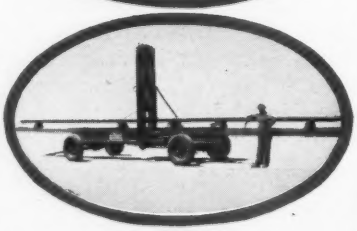

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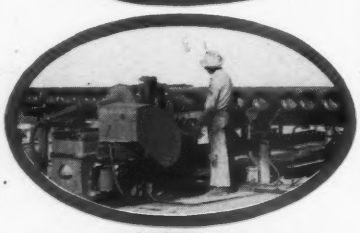

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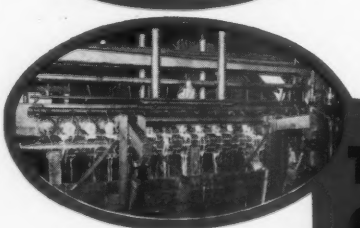

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Shiells Canyon Wildcat Deeper

In the Shiells Canyon area, T. & T. Oil Co. is drilling steadily at 3471 ft. with Hickler No. 1-A wildcat in Sec. 22-4n-19w, Ventura County. Electric log has been run. Circulation difficulties were encountered around 3450 ft.

Sespe Try Runs Pipe

Eagle Rock Petroleum Corp. is running casing in its Eagle Rock No. 1 wildcat in Sec. 36-5n-20w in the Sespe area, Ventura County. Present depth is 1343 ft.

Goleta Try Digs

Drilling has reached a depth of 10,057 ft. in Honolulu Oil's Honolulu-Signal-Macco State No. 309-2 in Sec. 19-4n-28w at Goleta in Santa Barbara County.

Montalvo Try Quits

In the West Montalvo area, Standard of California has abandoned Eastwood No. 1 test in Sec. 33-2n-22w, after questioning the well by stages from 9100 to 8400 ft. Total depth is 11,027 ft.

Ojai Adds New Producer

Swabbing and flowing by heads, Richfield Oil's Ojai No. 56 in the Ojai area is in the finishing stage. Total depth is 3853 ft., with casing set at 2798 ft.

Cat Canyon Wells Work

General Petroleum Corp, is drilling at 5938 ft. with Los Flores No. 36-22 in Sec. 22-9n-33w at Cat Canyon. Sunray Oil Corp.'s Dominion No. 1 in Sec. 23-9n-33w in the area is making a hole at 5541 ft. The former has casing set at 5700 ft. and the latter at 5450 ft.

Tar Creek Test Deepens

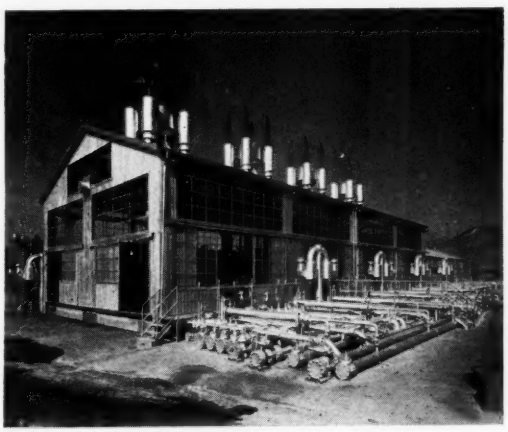
Republic Operator, Inc., has pulled liner from Brunton No. 1-A in Sec. 29-5n-19w at Tar Creek preliminary to drilling ahead from present depth of 4743 ft. About 1000 ft. more will be taken in before another trial is made. Swabbing at present level recovered mud with a trace of gas. The company's McGregor-Agnew No. 7-1 in Sec. 7-4n-21w in the Ojai area is drilling with cable tools at 614 ft.

Guadalupe Try Working

Continental Oil Co. is still working over its Sand-Dune-LeRoy No. 2 in Sec. 2-10n-36w at Guadalupe in San Luis Obispo County. The well, which is credited as a new oil discovery of some sort, has been troubled with sand and water. Plugged back from a total depth of 2759 ft. to 2740 ft., the well pumped 60 barrels in 20 hours, cutting 53 per cent. The project at last reports bailed sand.

Alondra Park Try Goes Deep

In the Alondra Park area, British-American Oil Prod. Co. is drilling at 6713 ft. with its Village Comm. No. 2 in Sec. 22-3s-14w, Los Angeles County.



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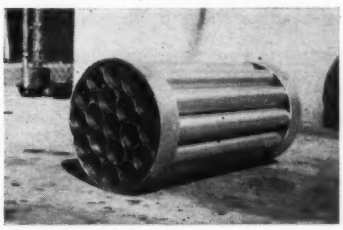

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San Joaquin Valley

Richfield Opens Cuyama Valley Oil

Richfield Oil Corp. has given positive confirmation of a new producing area in the Cuyama Valley by completing its Russell No. 1 there for an initial flow of 500 barrels daily. Open to production are 250 ft. of oil sand between 2970 and 3340 ft. The oil is clean and of 38.3 gravity. Carried to an original bottom at 4218 ft., the hole was subsequently plugged back to 3360 ft.

Anticipating production success of its Russell No. 1 on Sec. 5-10n-27w, Richfield during recent weeks has been stepping up it Cuyama Valley development program. Approximately 600 ft. west of the new discovery, Russell No. 2 in the section is drilling ahead below 1850 ft. Two and one-quarter miles northwest of Russell No. 1, the company's Anderson-Colegrove No. 1 on Sec. 30-11n-27w is standing with casing cemented at 2850 ft. The well is bottomed at 3022 ft. in oil sand. Top oil sand was reached at 2710 ft.

Richfield's light oil discovery at Cuyama Valley is only about 30 miles from a company pipeline system and readily accessible to the California's major refining districts.

It is too early to analyze the full impact of the discovery upon California reserves. At this writing, however, it appears that Richfield by finding commercial oil at a shallow depth at Cuyama Valley, may have opened a wide area to development. The company's ground in the area is no less than 150,000 acres. The venture was drilled under contract by Hoover Drilling Co. of Bakersfield.

Bandini Petroleum Co. is drilling below 1200 ft. with Graham No. 1 in Sec. 24-11n-26w. The company holds a total of 15,000 acres in the area. Three miles northwest of Richfield's discovery, Federal Oil Co. is starting a well on a 40-acre piece on Sec. 25-11n-27w. Holdings of the company include acreage elsewhere in the area.

McKittrick Test Starts

Western Gulf Oil Co. is ready to start work on its Fox O'Brien No. 1 wildcat in Sec. 31-29s-21e in the McKittrick area. Spencer A-U.S. No. 18-34 in Sec. 34-28s-20e at Bacon Hills is drilling hard shale at 4868 ft. B.V.A. No. 18-3 in Sec. 3-32s-25e at Buena Vista, likewise, is drilling hard shale at 11,130 ft.

Union Pacific Co.'s Well No. 5, in the Wilmington Field, Pongratz Oil Co., drilling contractors. Rear row, left to right: M. R. Knight, driller; "Rudy" Olme, derrick; J. C. Gregory, pipe racker; front row, left to right: I. B. Pipnoe, cat head, B. C. Strang, lead tong.

McKittrick Test Drills

Among Independent Exploration Co.'s important operations in San Joaquin Valley is Boweles No. 64 test in Sec. 17-29s-21e in the McKittrick area. The project at last reports was making rapid time with the drill below 2500 ft. Layman Two No. 44-17 in Sec. 17-28s-20e on the McDonald Anticline is drilling at 692 ft. At Shar'toot'n, Swan No. 3 in Sec. 15-28s-28e is pumping water and oil from a finishing depth of 2764 ft. O. C. L. No. 45-21 in Sec. 31-26s-18e in the Blackwell's Corner area has been abandoned at 2165 ft. Independent in company with Texaco is prospect drilling at 6565 ft. in K.C.L. No. 2 near the Wheeler Ridge field in Sec. 6-10n-20w.

Blackwells Test Rigs Up

Approximately two and one-half miles east of Blackwells Corner, British-American Oil Prod. Co. and Capital Co. are rigging up Beer No. 11-22 wildcat in Sec. 22-26s-19s, Kern County. The project is adjacent to a 13,000-acre block controlled by Superior Oil and Independent Exploration. The combination's Kovacevich No. 58-A in Sec. 26-31s-29e in the Arvin area is drilling at 7280 ft.

Raisin City Well Completed

Three-quarters of a mile northwest of the Raisin City field in Fresno County, K. R. D. Syndicate has completed No. 1 in Sec. 10-15s-17e for an initial yield of 150 barrels of 22 gravity oil daily through a 6/64-in. orifice. Cut was 2 per cent. The well was carried to a bottom at 5227 ft.

Edison Try Starting Off

J. Paul Getty is starting J.A.C. No. 2 test in Sec. 8-30s-29e in the South Portals area near the Edison field. Drill site is one-quarter mile east of J.A.C. No. 8, which was given up two years ago at 7360 ft. as a duster. East of the Edison field,

Morton and Sons has location staked for Nissen No. 20-1 in Sec. 20-30s-30e. This is about three-quarters of a mile southwest of A. T. Jergins' Nissen No. 1 wildcat, which went to 2766 ft. some 15 years ago in an unsuccessful hunt for new oil. Morton's Tejon Ranch No. 15 in Sec. 15-30s-30e is drilling ahead at 3527 ft.

San Emigdio Try Drilling

In the San Emigdio area, Apex Petroleum Corp., Ltd., is drilling Los Lobos No. 5 at 1180 ft. in Sec. 5-10n-22w. The company's Herring No. 1 in Sec. 14-32s-29e at Comanche Point is making hole at 5109 ft.

Mountain View Wildcat Drills

In Sec. 26-30s-28e in the Mountain View area, Union Oil Co. is drilling at 2640 ft. with K.C.L. No. 45-26. The company is coring at 4063 ft. in R. & K. No. 1 explorer west of the McKittrick field. Circulation troubles persist. Location falls in Sec. 34-30s-21e.

Kettleman Hills Wildcat Drilling

Standard of California's S. F. & F. L. No. 4-2, a Kettleman Hills South Dome outpost in Sec. 12-25s-19e has grown deep and continues to drill ahead at 12,650 ft. Location is east of the Devils Den area. Van Sicklen No. 45 wildcat in Sec. 26-27s-21e near the Lost Hills field is fishing for retainer, with present depth 8279 ft.

Pottenger Wildcat Digs

Texas Co. is coring ahead at 1735 ft. with its Universal No. 1 exploratory well in Sec. 19-30s-21e in the Pottenger area of Kern County. In the Ciervo area in San Benito County, the company is grading location for Nicholas No. 1 in Sec. 28-16s-12e.

Dos Palos Try Listed

Tide Water Associated Oil Co.'s Azevedo No. 48-29 in Sec. 29-10s-12e at Dos Palos in Merced County is still a location.

Bacon Hills Test Drills

Seaboard Oil Co.'s No. 58-21 in Sec. 21-28s-20e, an extension test of the Bacon Hills area, is drilling shale at 9257 ft. The company has spudded its von Glahn No. 8 venture in Sec. 16-29s-28e at Kern Bluff.

Cantua Creek Project Drills

In the Cantua Creek area in Fresno County, Superior Oil Co. is drilling at 372 ft. with Harnish Bros. No. 1 prospect job in Sec. 25-17s-16e. The company's O.L.C. No. 1 in Sec. 27-26s-19e at Blackwell's Corner is digging at 1390 ft.

Sunset Try Fails

Having encountered all shale and no sand, Honolulu Oil Corp. has abandoned its B & M No. 82 wildcat in Sec. 10-11n-24w in the Sunset area, Kern County.

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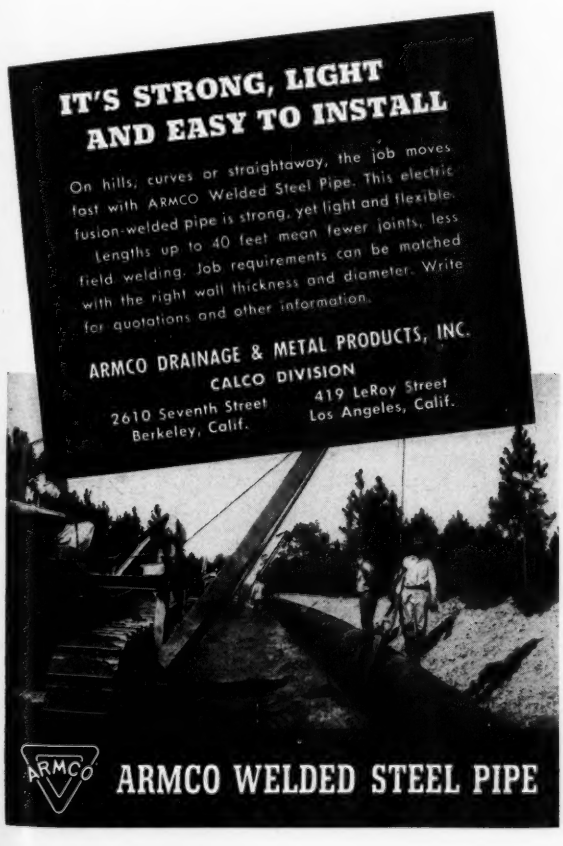
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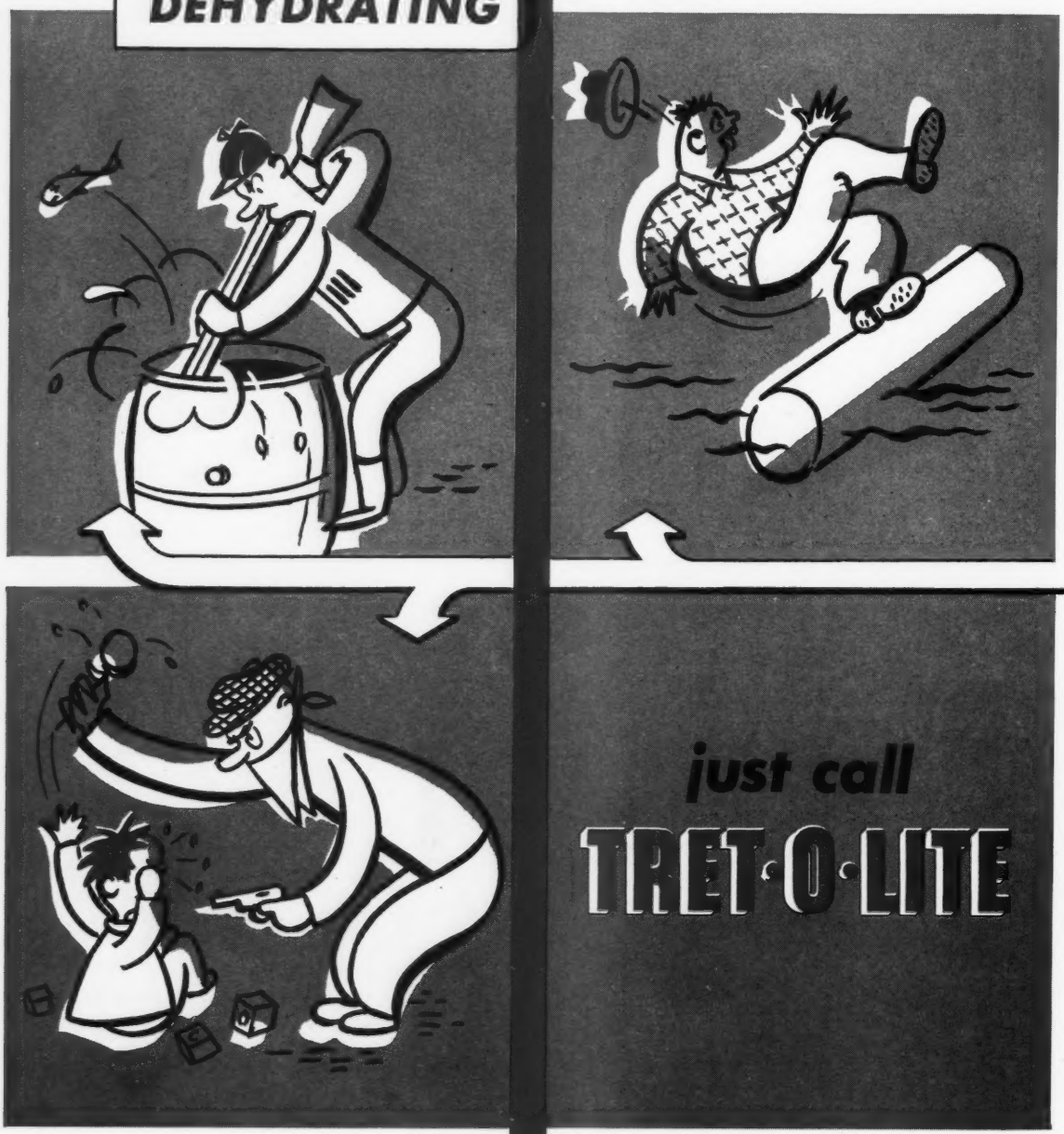

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Wheeler Ridge Tests Drilling

In Coal Oil Canyon in the Wheeler Ridge area, where Richfield recently turned up new oil, the company is drilling ahead at 3736 ft. with No. 63-29 in Sec. 29-11n-20w. No. 61-29 in the same section is drilling at 1054 ft. No. 78-20 in Sec. 20-11n-20w found nothing of interest and was abandoned at 2000 ft. The company, meantime, is rigging up Lakeside No. 67-24 in Sec. 24-31s-25e in unproved ground at Paloma.

McKittrick Try Redrills

Redrilling at 5207 ft. is the present operational move of Signal Oil and Gas Co.'s Signal Pike No. 1 prospect job in Sec. 10-30s-22e in the McKittrick area. Original depth is 6331 ft.

Midway-Sunset Wells Programmed

Campbell and Swallow, Operators, have programmed three wells in Sec. 23-31s-22e at Midway-Sunset. The initial job will be a 2300-ft. test. The ground was subleased from Sunray Oil Corp.

Moody Gulch Well Planned

Location for Gulch No. 3 has been staked by Gulch Petroleum Co. in Sec. 8-9s-1w in the Moody Gulch area in Santa Clara County.

New Bulletin by National

Diesel Drilling Engine. Superior PTD Diesel Drilling Engines, including engines with dual fuel equipment, are described and illustrated in a new 20-page bulletin, No. 318-A. These are naturally-aspirated 6- and 8-cylinder engines with 8½-in. bore and 10½-in. stroke, rated at 300 and 400 Hp. respectively at 900 rpm. for continuous operation. Both power and speed are greater than specified in the superseded bulletin.

Bulletin 318-A describes the main components of the engine and illustrates construction features. It includes new material and pictures of the engine with dual fuel equipment, new performance charts and specifications. Copies are available from The National Supply Company, Box 899A, Toledo, Ohio.

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Jasmine Try Cased

Casing is being run in Mayflower Oil Co.'s J.O.L. No. 1 in Sec. 23-25s-27e in the Jasmine area of Kern County. Total depth is 2828 ft. in granite. Weathered granite was topped at 2794 ft. and hard granite at 2810 ft.

Johnston Stainless Welding Rods

PROVEN QUALITY SINCE 1931

•

A. P. JOHNSTON

1845 E. 57th St. - Los Angeles 11, Calif.

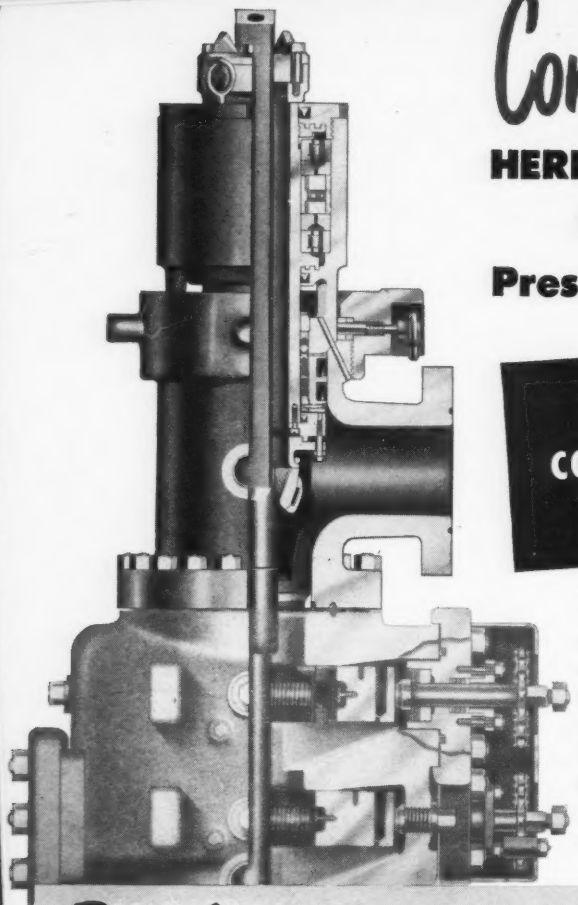
California Oil World's Monthly Summary

CALIFORNIA DEVELOPMENT AND PRODUCTION

	APRIL, 1948, DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 4 Months	Daily Average April 1948	Daily Average April 1947
SAN JOAQUIN VALLEY REGION						
Ant Hill					1,143	1,567
Antelope Hills					1,226	1,352
Bellevue					296	309
Belridge—North					3,912	5,821
Belridge—South	1	6	225	15	6,328	9,438
Blackwell's Corner					137	179
Buena Vista Hills	2	1	48	2	45,844	46,927
Canal					2,021	2,055
Coalinga Group						
Eastside	3	3	142	11	18,404	15,587
Oil City					82	97
Coalinga—Nose					52,411	51,897
Coalinga—Northeast	1	2	781	3	9,695	8,463
Pleasant Valley	1				3,460	4,125
Jacalitos	2	2	933	6	5,864	4,728
Westside	2	3	95	15	7,057	6,835
Coles Levee—North	1	1	259	3	16,241	16,645
Coles Levee—South				1	2,590	3,259
Edison		3	345	9	11,187	11,149
Elk Hills	4			2	6,149	7,678
Fruitvale	1				6,537	6,911
Greeley					13,996	10,072
Helm					3,876	4,221
Kern Bluff		5	405	14	748	
Kern Front		7	343	20	9,149	8,953
Kern River	9	26	767	119	12,222	9,912
Kettleman North Dome	4			4	34,985	37,133
Lanare					1,478	2,238
Lost Hills		9	554	37	7,283	4,924
McKittrick Group						
Belgian Anticline	1			26	1,114	
Cymric	2	15	832	16	19,434	14,048
McKittrick	1			3	2,824	2,964
McKittrick Front					1,831	1,463
Salt Creek					6,113	5,479
Sheep Springs					980	362
Temblor Ranch					97	130
Midway-Sunset	9	7	502	29	42,606	43,218
Mt. Poso Group		1	50	4	13,180	14,577
Mountain View	2			4	3,844	6,343
Paloma		2	989	11	11,778	8,003
Poso Creek Group	1			5	3,506	3,761
Pyramid Hills					238	279
Race Track Hill		1	154	3	2,177	2,106
Raisin City	3	1	70	1	2,798	2,748
Rio Bravo					12,124	12.460
Riverdale					3,131	4,358
Round Mountain Group	1	1	80	10	7,677	8,971
Strand					708	1,489
Strand—East					481	496
Tejon Ranch		2	208	4	3,403	3,160
Ten Section	1			1	7,149	7,776
Union Avenue					248	334
Wasco					130	204
Wheeler Ridge	1				215	217
Other Fields	3	6	123	17	1,305	627
TOTAL—San Joaquin Valley Region	56	104	7,905	395	433,412	428,048
COASTAL REGION						
Santa Maria District						
Barham Ranch (Los Alamos)					15	
Casmalia				4	1,030	480
Cat Canyon—East					533	598
Cat Canyon—West	2	4	578	13	15,067	11,186
Four Deer	1	1	96	4	624	
Gato Ridge	1				3,655	3,407

	APRIL, 1948, DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 4 Months	Daily Average April 1948	Daily Average April 1947
COASTAL REGION—Continued						
Lompoc	1	3	291	12	6,324	4,212
Olivera Canyon					453	
Orcutt	1	1	71	8	4,793	4,124
Santa Maria Valley	2	3	116	6	20,920	28,342
Zaca Creek	2	1	667	3	1,202	481
Santa Barbara District						
Capitan					2,658	2,832
Elwood	3				7,270	7,320
Santa Barbara					77	93
Summerland					2	2
Ventura District						
Montalvo West	1			1	149	82
Padre Canyon	3	1	386	3	5,366	3,133
Rincon				1	3,385	3,872
San Miguelito	1	1	1,604	2	5,484	4,925
Ventura Avenue	8	2	680	8	51,467	46,570
North Santa Clara District						
Del Valle	3	2	221	6	9,815	8,146
Hopper Canyon					186	144
Oak Canyon				1	2,040	1,623
Sespe Canyon Group	2			1	221	225
Temescal					553	604
Others	1	1	64	3	530	225
South Santa Clara Valley District						
Aliso Canyon	3			2	3,329	3,440
Bardsdale	2	1	16	6	630	379
Newhall-Potrero	6	1	423	3	7,041	6,161
Oxnard					1,428	1,101
Shiells Canyon				1	1,003	1,055
South Mountain	4	3	908	9	5,638	4,796
West Mountain	1	2	230	4	951	301
Others	1	3	187	5	881	764
San Luis Obispo, Santa Barbara, Santa Clara and Monterey Counties	1	2	48	2	138	24
TOTAL—Coastal Region	50	32	6,586	108	164,863	150,647
LOS ANGELES REGION						
Brea-Olinda	4	3	611	9	14,412	11,354
Coyote—East	2	1	57	1	4,896	5,012
Coyote—West	5	3	246	9	15,215	15,355
Dominguez	2	1	120	2	13,889	14,788
East Los Angeles				1	1,670	1,064
El Segundo					370	426
Huntington Beach	18	19	1,977	86	56,652	49,465
Inglewood	3	3	422	6	11,316	11,922
Long Beach	2	2	219	6	23,685	23,770
Montebello					6,977	7,579
Newport	4	6	265	22	6,409	7,283
Playa Del Rey					1,956	2,143
Potrero	2			2	1,171	836
Richfield		1	68	2	6,218	6,608
Rosecrans-Athens Group	1	1	10	3	4,631	4,631
Santa Fe Springs		4	122	6	15,703	16,348
Seal Beach	4	1	488	5	11,788	10,786
Torrance		1	64	2	7,864	8,322
Whittier	1				975	995
Wilmington	16	16	3,284	69	135,964	127,082
Yorba Linda				2	1,200	190
Other Fields	3			3	2,109	1,776
TOTAL—Los Angeles Region	67	62	7,953	236	345,070	327,735
EXPLORATORY						
Outpost Wells	29					
Wildcats	15					
Gas Wells	1		Gas	13		
TOTAL CALIFORNIA	218	198	22,444	892*	943,345	906,430

*Includes Gas Wells completed and 140 Drilling Wells abandoned.



Compare them all...

HERE'S THE MOST VERSATILE, MOST POSITIVE, MOST COMPLETE Pressure Control Unit Yet Developed!

THE SHAFFER TYPE 46 COMBINATION ROTATING BLOW-OUT PREVENTER AND STRIPPER

BEFORE YOU DECIDE on the selection of *any* control equipment for drilling under pressure, we urge you to make an impartial comparison of all other units against the multiple advancements incorporated into the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper. For wide-range versatility, positive safety and all-around operating efficiency, you'll find the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper is unequalled. Here are just a few of many far-reaching advancements incorporated into its design. Check them over—then get the complete story on this years-ahead unit.

Point 1. **CONTINUOUS PACK-OFF:** When pressure emergencies occur, there's nothing to operate, nothing to set in order to pack-off around the drill string, because the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper maintains its leak proof seal continuously. It is *always* ready, *always* packed off, *whether the drill string is rotating, is being raised or lowered, or is hanging motionless in the well!*

In addition, the design of the unit is such that increased well pressure only assists in sealing the stripper rubber more tightly against the drill string. The higher the pressure the tighter the seal—*automatically!*

Point 2. **ANY SHAPE:** The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper not only maintains a continuous pressure-tight seal, but also expands and contracts *automatically* to fit various shapes and diameters in the drill string. It seals around the square sides of a kelly as efficiently as the round drill pipe—and hexagon or octagon shapes as well. And (excepting such abnormally large diameters as reamers and bits) even varying diameters such as tool joints, upsets, couplings, etc., strip through the unit without losing the pressure-tight seal.

Point 3. **NEGLIGIBLE WEAR:** Because the stripper unit rotates *with* the kelly—not around it—wear on the stripper rubber is reduced to an absolute minimum. Also, this feature assists in maintaining a tighter seal because the seal around the kelly is not subjected to continuous flexing or change of sealing contact as the string rotates.

Point 4. **TROUBLE-FREE BEARINGS:** In the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper the bearing assembly upon which the unit rotates is specially engineered to withstand the severe impact and rotational loads of modern high speed drilling. Separate bearings carry the thrust and radial loads, and radial bearings are separated to give maximum resisting moment against stresses induced by an off-center wobble in the kelly. All bearings are lifetime prepacked with heat-resisting lubricant, further minimizing maintenance and assuring maximum trouble-free performance.

...and many other features

The above are only typical of the many unique advancements you'll find in the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper. Others include the Quick Releasing Bonnet that permits passing bits, reamers, etc., by simply pulling a latch and rotating the bonnet 1/6 turn . . . the Steel Reinforcing Latches that prevent damage to the stripper rubber by pulling large diameters through it—or by excessive well pressures . . . the Compact Construction that saves cellar space, and still other vital advantages.

The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper is available in a complete range of sizes for all modern drilling operations. Write direct for further details on how this unit can solve your pressure drilling requirements—or see your Shaffer representative for further information.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
CASPER, WYOMING, Mountain Sales and Service, 133 North Wolcott Street
EXPORT SALES OFFICE: Shaffer Tool Works, 30 Rockefeller Plaza, New York, N. Y., U. S. A.

SEND FOR THE NEW 1948 SHAFFER CATALOG!

See pages 3843 to 3894 of the new 1948 Composite Catalog for data on the complete line of Shaffer products.

Emsco Rig Control Cracks Egg With 35,000-Pound Mast As Oil Show Feature

Demonstrating a touch of the iron hand within the velvet glove at the International Petroleum Exposition, Tulsa, Okla., Emsco's GA-350 Rig, operating with a 35,000 pound portable mast, put on an egg-cracking stunt that will have the boys talking about the rig for a long time to come.

Mast is lowered fraction of an inch, to crack egg without smashing it.

The demonstration was developed by the advertising agency that handles the Emsco and other accounts represented at the exposition.

Twice a day the portable mast of Continental Supply Company, controlled by the GA-350 Emsco rig, was raised and lowered to show visitors the facility of operation. Norman Roe, with the advertising agency, watching the perfect control and functioning of the rig with its super-sensitive braking feature, suggested to H. A. Hilborn, Emsco's chief structural engineer, that it would be possible to crack an egg, between the lowering mast and its support when in the horizontal position, and they proceeded to prove it.

With Elmer Cleaver, an Emsco man at the controls, the huge mast was lowered to a position just above an egg, held on the ground support by Roe. When Cleaver received Roe's signal the mast was lowered a fraction of an inch, enough to crack the egg but not to demolish it, and on another signal the mast was gently raised again, a moist spot on the structure the only evidence that it had cracked the egg as daintily as a home economics demonstrator before a class of budding housewives.

Emsco's GA-350 rig is a 350 h.p. drawworks designed to fit handily into rapidly expanding portable rig operations.

New, Compact 75-Ton Connector

Manufactured by the Oil Tool Division of the Byron Jackson Co., this new 475 "Stubby" Connector is only 22½" from shank pin to link seat.

Designed for operators who need maximum clearance in portable and mast-type drilling, this recently developed Connector has an optional equipment (1) a bail or (2) suitable adaptors for direct-connection to popular makes of blocks. A clevis, for sidehook attachment, is extra equipment for use with single bail casing tools. As an example of the space-saving advantages of the "Stubby" . . . when adapted to a popular make 36" x 24" block, the overall length is only 70⅞".

The advantages of the short connector are achieved by inverting the shank design of the Super Triplex line of hooks. A new housing design, with sturdy link supporting ears, fully encloses the working parts. The shank is made from a forged and heat treated piece of alloy steel and has no load-carrying threads. While the sub-shank and the sub-shank nut are threaded they are subjected only to the down thrust of the low-stress relief springs. The two springs give 6" of soft spring travel . . .

New Byron Jackson 475 "Stubby" Connector is only 22½ inches from shank pin to link seat.

floating action that eliminates exact spotting of the travelling block. Provides greater ease in handling heavy loads and eliminates galling pipe threads. A 30° pendulum action of the housing, plus the added pendulum action between the adaptor and the shank, provides maximum flexibility between the "Stubby" and the travelling block.

Standard alemite fittings are incorporated to provide the best type of lubrication. The sub-bearing is self-lubricated.

Byron Jackson Co., Oil Tool Division, Box 2017, Terminal Annex, Los Angeles 54, California.

Progress is the American Way of life. The petroleum industry IS progressive.

New Bumper-Sub Safety-Joint

A combination bumper-sub and safety-joint has been introduced by the Shaffer Tool Works as an oil tool with advantages over conventional equipment. It is claimed that by using a new type of spring arrangement, the tool is assembled with a preloaded spring compression that holds the bumper safety joint locked in an open position at all times and under all drilling conditions until it is desired to strike a downward blow.

According to the manufacturer, to operate the bumper safety joint, a weight equivalent to approximately 2,000 feet of drill pipe is lowered onto the tool. This weight actuates a tripping mechanism which automatically releases, allows the weight of the pipe to strike a heavy downward blow, and then automatically re-cocks itself after the blow has been struck. Blows can be struck repeatedly and continually as long as desired by raising and lowering the drill string. The weight necessary to trip the tool can be varied, if desired, when assembling the tool.

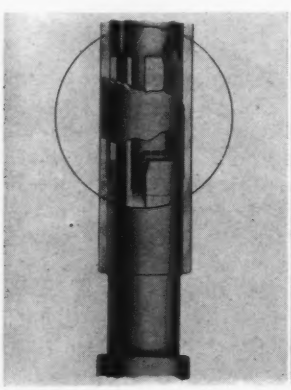
As a bumper-sub the new device is described as having advantages over conventional bumper-subs, in that the tool remains locked in the open position until the required weight of drill pipe is lowered against it. When drilling with drill collar weight, the tool can be placed immediately above the drill collars to provide protection to the drill string. Should it be desired to apply additional weight during the drilling operation, the weight of as much as 1800 or 1900 feet of drill pipe can be added to the bit without tripping the tool, it is claimed, thus providing a safety factor to meet various drilling requirements.

Since the tool remains in a locked position during normal operations, there is no "working" of the joint—therefore no wear on the packing unit or other operating parts. This reportedly lengthens the life of the tool and insures minimum maintenance and wear. Yet whenever a solid downward blow is desired for loosening stuck pipe, breaking through bridges, etc., the manufacturer states that it is only necessary to lower the required amount of weight onto the tool, whereupon the blow is automatically struck, and can be struck repeatedly.

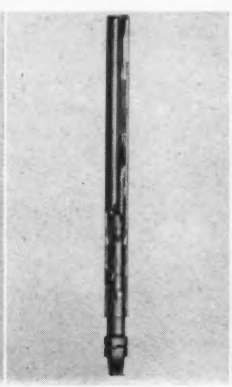
In addition to its use as a bumper sub, the new development is described as incorporating a safety joint feature that has advantages over conventional safety joints. To operate the safety joint, it is stated that reverse torque is placed on the drill string and then the required amount of weight to actuate the bumper sub is placed on the tool. The unlocking of the bumper sub, coupled with the reverse torque on the string, rotates the driving lugs into an unlocking slot similar to that of a "J" tool. Then by lifting the drill string, the top half of the tool is removed along with the drill string, leaving the lower half in the hole with the drill collar.

An important advantage of this design is described to be that the safety joint in this tool arrangement is the strongest joint in the string instead of the weakest as in conventional safety joints. Until reverse torque, coupled with the weight of at least 2,000 feet of drill pipe is placed on the tool, the safety joint will not unlock, it is claimed,—yet the safety joint releases readily when the prescribed operations are performed. Because of this safety feature, continuous reverse rotation can be performed, if necessary, with applied weight of not only the drill collars but also that of the drill string up to almost 2,000 feet of pipe.

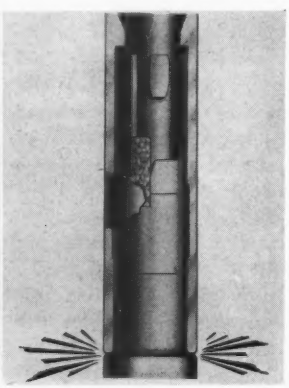
The bumper safety joint is further described as being packed off to permit full and continuous high pressure circulation during drilling operations, and has adequate internal diameter to permit passage of wire line equipment. Because it combines in one tool the protection normally requiring two tools in the drilling string, this new development is introduced as an advancement in drill string protection. It is available in sizes to meet normal drilling requirements.



Shaffer-Waggoner Bumper Safety Joint, as a safety joint.



Safety Joint in locked position.



Safety Joint in Bumper Sub Position.

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I. P. E. Survey Available

Facts to enable International Petroleum Exposition exhibitors to evaluate the attendance and aid in making plans for the next Exposition have been compiled in a survey conducted at the recent oil show.

The survey, showing the actual attendance of oil men at the Exposition, was made by Leslie Brooks & Associates, of Tulsa, oil field research specialists, and will be published and made available in July to those subscribing for the survey.

The survey will show attendance of actual oil men (eliminating non-oil men, women and children and repeat attendance) according to industry divisions, occupational or job classifications, and geographical areas; how many days and hours per day were spent at the show by average oil men attending, how those attending rated the show; whether they expect to attend the next show.

Survey copies may be obtained from Leslie Brooks & Associates, McBirney Building, Tulsa, Oklahoma.

* * * *

Progress is the American Way of life. The petroleum industry IS progressive.

McCullough Announces New Tool

A new, sonic indicator that removes guesswork about down-the-hole conditions has been announced by McCullough Tool Company, Los Angeles.

This new indicator, an electronic device, has been incorporated as an integral part of the McCullough Electrical Firing Gun Perforator. It is invaluable for accurately locating collars, liner tops, fluid levels and well bottoms, instantly and accurately as the gun meets them and in ascertaining movement of the gun or speed of its movement by sound.

When used with the new McCullough supersensitive electronic Weight Indicator, the instrument provides an audible and visible check giving positive information at all times on gun location and movement in relation to line speed.

The device operates in the following manner:

Finder wires protrude from the Electrical Firing Top Assembly of the McCullough Gun Perforator. As the gun perforator is lowered into the well these finder wires scrape along the inside of the casing. The sound produced is transmitted through the radio panel in the McCullough Electric Truck Unit where the operator listens for identifying sounds. Every down-the-hole condition makes its own distinctive sound, every change in gun movement signals itself by change of sound. When the gun is fired, the detonation can be heard by the operator eliminating all guesswork in this respect.

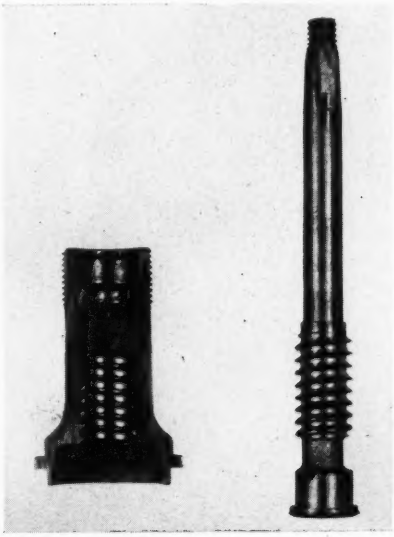
The sonic device is another exclusive service developed by McCullough to provide accurate information at the surface while the job is in progress in the well.

Full information on its use and availability may be obtained from the McCullough Tool Company, 5820 S. Alameda Street, Los Angeles, California.

Patented Stem Material Announced By Lunkenheimer

Although previously used in millions of its bronze valves, the development of a new stem material has only recently been announced by The Lunkenheimer Co., Cincinnati, Ohio.

Reports from the field have proved conclusively the results of exhaustive laboratory tests, in which the Lunkenheimer Alloys (Symbols "RSB" and Alloy "6") outlasted conventional materials by a wide margin. In one test, the stem in a Lunkenheimer Fig. 73 "Renewo" Globe Valve completed 305,000 cycles (open and close against steam pressure). At the end of the test, the threads were still working well.



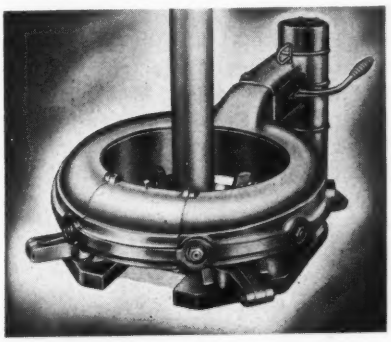
LUNKENHEIMER — Fig. 73 Globe Valve Test Stopped at 305,000 cycles Steam Bronze Hub — Cast Silicon Bronze Stem (Stem still working well, altho partly worn)

Patents have been granted on the alloy; it is used in all Lunkenheimer valves with bronze stems. The manufacturer states that the new stem minimizes stem thread troubles, formerly a major cause of valve failures. Out of millions of Lunkenheimer valves equipped with these exclusive alloy stems, not one has been returned because of stem thread failure.

In addition to its wear and abrasion resistance, the new stem alloy is said to resist corrosion and dezincification.

New American Iron Simplo-Trip Power Slips

These power slips, newly developed by American Iron, center the drill pipe before the slips take hold. Perfect centering of drill pipe is now assured, according to the manufacturer, by the use of 4 guide rollers . . . one above each slip. There's no



stripping on or off the drill pipe because these slips can be taken on and off by one man, without the aid of a catline. They're as simple to put into action as a set of tongs! These power slips have proven themselves to be safe, efficient and labor-saving. They put the driller in complete charge of pipe running and pulling operations.

Republic Steel Issues New Bulletin

"Republic Electric Weld Oil Country Goods" is the title of a new 8-page, 2-color, booklet just issued by Republic Steel Corporation. The booklet gives the highlights of the manufacture of Republic Electric Resistance Weld Pipe as the process affects the quality of the product. It points out the advantages of the electric weld process for oil country line pipe, casing and tubing.

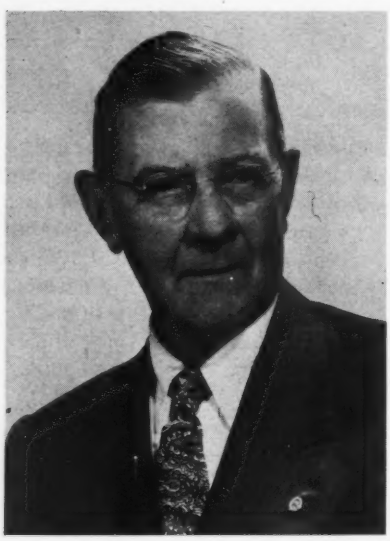
Available upon request to Republic Steel Corporation, Advertising Division, 3100 East 45th Street, Cleveland 4, Ohio. Ask for Form ADV 504.

Personalities IN THE NEWS

Martin Succeeds Adams at G. P.

Retirement of E. L. Adams as vice-president, director, and director of the pipe line department of General Petroleum Corp., was announced at the company's home office in Los Angeles recently by R. L. Minckler, president.

Election of J. L. Martin, general superintendent of the pipe line department since 1932, as director of the pipe line department and a director of the company to succeed Mr. Adams was announced simultaneously.



J. L. Martin

Mr. Adams, a 1908 graduate of the University of California, joined General Petroleum in 1912 as a civil engineer on pipe line construction. He became a director in 1932 and vice-president in 1936. He is a member of Tau Beta Pi and Sigma Xi, engineering and scientific honor societies, respectively, a Mason, Shriner and member of the Scottish Rite 32nd degree Masons. He is a member of the American Society of Civil Engineers.

Mr. Martin came to General Petroleum in 1913 as assistant superintendent of the pipe line department at Taft, following pipe line experience with other companies in Missouri, Illinois, Indiana, Oklahoma and California. He has been general superintendent since 1932. Like his predecessor, Mr. Martin is a Mason, Shriner and Scottish Rite member, and a member of the Petroleum Production Pioneers.

* * * *

Paschall Advances At H. C. Smith Oil Tool

Appointment of Hearn J. Paschall as division manager of Mississippi for the H. C. Smith Oil Tool Co., has been announced by Ronald C. Smith, general sales manager.

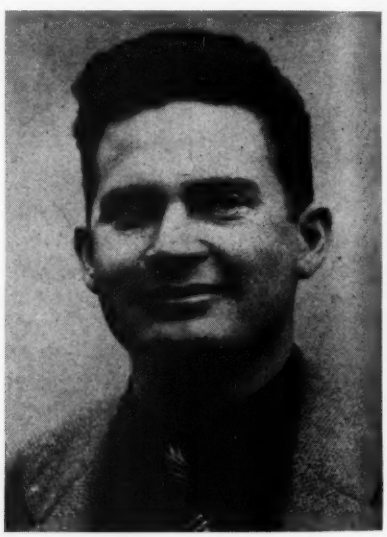
Hearn J. Paschall

The Company's headquarters will be located at 709 Orleans Street, Natchez, Mississippi. Mr. Paschall has been associated with the H. C. Smith Oil Tool Co. for the past 10 years and until recently was the company's branch manager in Santa Maria, California.

A few months ago, Paschall made an extensive tour of the various oil fields throughout the Middle East in the interest of his firm.

Coleman of Petreco Returns to Army

Thomas V. Coleman, Jr., design engineer for Petroleum Rectifying Company at Long Beach, California, has recently been called back to active duty. Coleman holds the rank of captain, and will return for service with the Signal Corps Headquarters at Ft. Monmouth, New Jersey.



Thomas V. Coleman, Jr.

Mr. Coleman joined the Petreco organization in April, 1946, after leaving the army. During World War II he saw action with the Anti-Aircraft Artillery in North Africa, Italy and Southern France.

While he was engaged in the oil industry with Petreco, Mr. Coleman was a member of A.S.M.E., and Secretary of the Professional Divisions, Southern California Chapter of A. S. M. E. He was also affiliated with the C.N.G.A.

Orville Stanford has been appointed Drilling Superintendent for Camay Drilling Company.

Mr. Stanford has had a widespread experience in the oil drilling

business and is a member of a family long identified with the industry.

At the outbreak of World War II, Stanford was drilling wild cat wells for the Far East Oil Development Company in the Philippine Islands. He volunteered for military service and was appointed a Lieutenant in the army engineers. He was on the Island of Cebu when the American forces there surrendered to the Japanese. At the time of the surrender, Stanford was on detached duty in the interior. He then organized and led Philippine Guerrilla bands on the Islands of Cebu and Leyte, in their continued warfare on the Japanese.

He was finally captured on the Island of Leyte, and spent three years in Japanese prison camps. He was decorated by the army for "gallantry in action." After his release to inactive duty, he was sent to Japan to appear against his Japanese captors at their trials.

Mr. Stanford conducted the Camay Drilling Company's drilling operations in the Hawaiian Islands prior to his appointment as Drilling Superintendent.

* * * *

G. P. Announces Promotion In Production Dept.

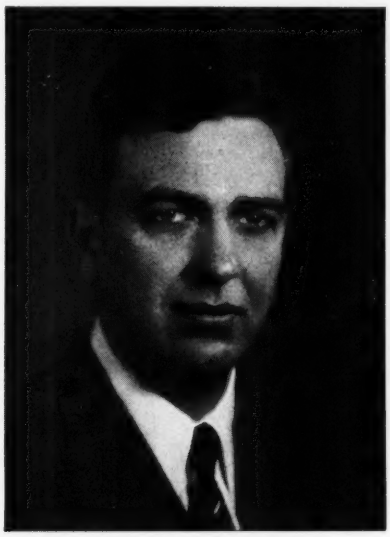
Promotion of E. V. "Jim" Watts to the position of Assistant to the Superintendent of the Southern Division of General Petroleum Corporation is announced by M. S. App, the company's Director of Production.

Simultaneously, promotion of Don B. Priest to be Assistant to the Superintendent of the Coastal Division was announced by R. O. Swayze, manager of California Operations.

A third appointment is that of A. F. Barrett to be Assistant Manager of Rocky Mountain operations with headquarters at Casper, Wyo.

Mr. Watts, who has just completed a year as chairman of the Pacific Coast District of the Division of Production of the American Petroleum Institute, is a prominent figure in western oil circles. He is a past chairman of the California district of the API Production and Practice Committee; formerly a member of the engineering subcommittee of the Production Committee under the Petroleum Administration for War; a member of the Conservation Committee of California Oil Producers and a member of four district committees under the conservation group.

A 1936 graduate in engineering from the California Institute of Technology, Mr. Watts is a member of Tau Beta Pi, national honorary engineering fraternity and a wearer of the Honor Key awarded to from eight to 10 per cent of each year's Cal-Tech class. He was secretary of the student body and participated in football and track.



E. V. Watts

Mr. Watts joined General Petroleum as a roustabout following his graduation and quickly rose to the rating of engineer. Prior to advancement to his new post he has served as engineer in the production department at the company's Vernon plant.

Mr. Priest, a graduate of the University of California in 1936, joined the company the following year as a well puller. He progressed through various ranks to become petroleum engineer in the geological department at Ventura in 1944, the position he held at the time of his present promotion.

Ned Clark, son of U. S. Marshal Bob Clark, has been advanced to manager of Shell Oil Co.'s coastal division, with headquarters at Ventura. Clark previously was superintendent of the company's Los Angeles division. He recently toured interior points in China, London and Shell headquarters at The Hague.

Dragon Advanced At Columbia Steel

Appointment of Paul L. Dragon as Assistant Director of Industrial Relations for Columbia Steel Company, subsidiary of U. S. Steel Corporation, was announced recently. Dragon has been transferred to the general offices in San Francisco from the Pittsburg (Calif.) Plant of Columbia, where he served as Supervisor of Industrial Relations.

J. D. Macarthur succeeds Dragon as Plant Supervisor of Industrial Relations and I. E. Vredenberg has been named Assistant Supervisor.

After graduating from the University of California with a Civil Engineering Degree, Dragon went to work for Paraffine Products, Inc., where he served as Personnel Supervisor. He joined Columbia in 1937 and was made Plant Supervisor of Industrial Relations in the following year.

Macarthur is a graduate of Stanford University. Before joining Columbia in 1943, he taught at Pittsburg High School and was later Principal of Sommerville School.

* * * *

Four promotions in the geological department of the General Petroleum Corporation have been announced at the company's home office in Los Angeles.

N. R. Shade becomes Assistant to the Director of Exploration, Frank B. Carter is named to a similar position, and E. L. De Maris is promoted to Supervisor of Exploration, all in the company's home office. Victor H. King becomes Supervisor of Exploration in the Rocky Mountain Division with headquarters at Casper, Wyo.

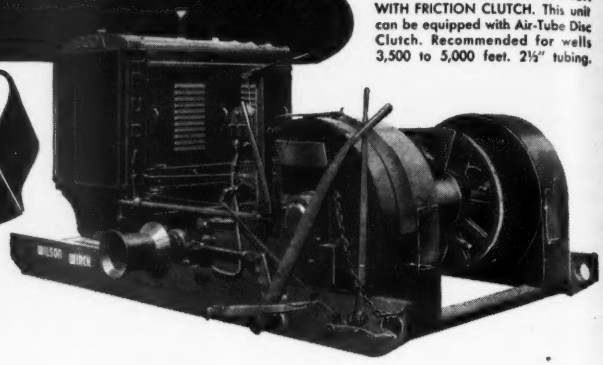
* * * *

Reese H. Taylor, president of Union Oil Co., was the guest speaker at the meeting of the New York Society of Security Analysts at New York.

J. Ben Carsey is California agent for Humble Oil & Refining Co. of Houston, which recently entered the California picture and opened offices at 621 South Flower street, Los Angeles. Peter Booth is land department head, Hunter Yarborough, staff geologist, and J. B. Hudson, geophysicist.

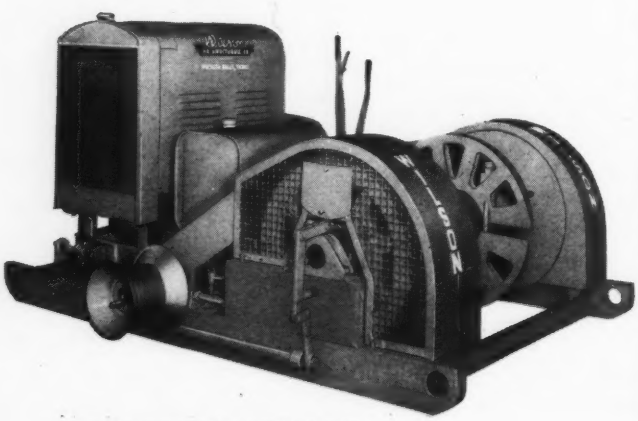
CONSISTENTLY TOP PERFORMERS IN WELL SERVICING

Wilson WINCHES



WILSON SUPER MODEL WINCH WITH FRICTION CLUTCH. This unit can be equipped with Air-Tube Disc Clutch. Recommended for wells 3,500 to 5,000 feet. 2½" tubing.

When your winch is a Wilson, you get top performance – consistently. Fast, dependable braking power . . . smooth and positive engagement . . . sound reinforcement throughout . . . and the toughest, most accurate shafts ever put into a winch. The same precision in design and construction is put into Wilson Winches that makes the great Wilson Super Titan Model Rig capable of drilling 21,600 feet into the ground. For exceptional performance every day, make every winch a Wilson!



WILSON SENIOR MODEL WINCH. Note full length counter shaft which has catheads on both ends. Rotary drive sprocket and clutch can be substituted for left cathead. Recommended for wells up to 3,500 feet.

1. CAST, SEMI-STEEL BRAKE RINGS machined after assembly for true running braking surface
2. WILSON DISC TYPE FRICTION DRUM CLUTCH, or FREE ROLLING JAW CLUTCH DRUMS, optional
3. FULL HARDENED, DOUBLE STEP, REPLACEABLE JAW CLUTCHES
4. CAM OPERATED, FULLY EQUALIZED SELF-ENERGIZING FULL WRAP BRAKES
5. ALLOY STEEL, DOUBLE HEAT TREATED SHAFTS, accurately ground to size
6. SPLINED SHAFTS wherever possible
7. HEAVY DRUM BARRELS, reinforced inside
8. DRUM ENDS REINFORCED WITH HEAVY "T" SECTION RIBS
9. DRUM BEARING BOLTS CLEAR THROUGH FRAME

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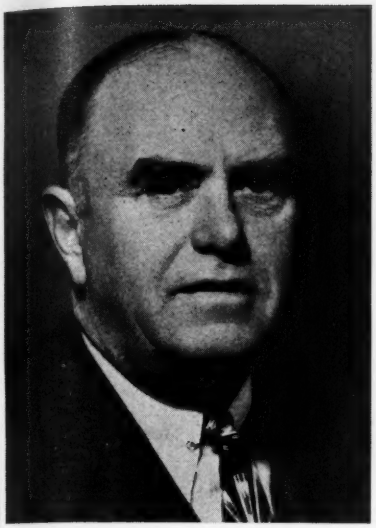

E. S. Dulin, president of the Byron Jackson Co., was elected a member of the board of directors of Lockheed Aircraft Corp. at the annual meeting of the stockholders held recently at Burbank, Calif. As president, Dulin heads up the three main divisions of the company—the pump division, the oil tool division, and the Patterson-Ballagh Co. Part of the company's service to oil well operators is supplied by the International Cementers, Inc. —a subsidiary of the Byron Jackson Co. Products of the company include pumps, oil tools, and oil well rubber specialties.

The main speaker at the meeting of the National Oil Scouts and Land Men's Association in Denver was Ira H. Cram, exploration manager for Pure Oil Co. Widely known in California, he expressed the conviction that the yet untapped oil resources in the country are potentially large.

Peter J. Burgoyne of Texas Co.'s Wilmington refinery toured the country as a drummer with leading concert, show and dance bands before joining Texaco in 1929. During his travels he gathered a wealth of anecdotes.

Ben Lubert, formerly manager of the lease and legal department of the Eagle Oil & Refining Co., has announced the removal of his offices for the general practice of law to the Chester Williams Building Los Angeles.

William Paine, Norman C. Wells and Carla Stafford Lewis have organized Alrac Oil Co. in Wilmington. The company is designed to engage in the drilling and producing of oil wells in California.

Roy Wm. Carver who has been suffering from a heart ailment for the past two months died at the Good Samaritan Hospital Wednesday morning, June 9.

Mr. Carver was very well known in the California oil industry. Following his return from European service in World War No. 1, he entered Stanford University. After his graduation from the University he was associated with the land departments of the Superior and Getty organizations. In 1930 he joined the Rio Grande Oil Company as Manager of the Land Department and held the same position after the organization of the new Richfield Oil Corporation from 1937 until 1944. He has since been independently engaged in the land and lease business in California, Texas, and New Mexico. As a result of this long and active career he has been closely identified with the discovery of a number of important oil fields and with the growth of some of our most important producing companies.

He had unusual ability in getting big jobs done and at the same time making friends in all walks of life, both in and out of the oil industry. He was a member of Al Malaikah Shrine, the Jonathan Club, the Los Angeles Country Club, and the Petroleum Club.

He is survived by his widow, Mrs. Miriam Carver, and two boys, Roy Wm. Jr., and John.

E. M. Smith, head of Globe Oil Tools Co. at Los Nietos, has returned from a trip around the eastern harness racing circuit. Smith is the inventor and manufacturer of a patented starting gate used throughout the country.

Edward M. Loftus, extensive oil land owner, and his son Winfield, have left Los Angeles on a vacation tour of Chicago, Detroit, Boston and New York. During his stay in the east, Loftus will attend the 35th reunion of his alma mater, the University of Maine.

R. L. Curtis, general manager of the Dow Chemical Co.'s Great Western division, has been added to the board of directors of the corporation.

M. J. Galpin of London, England has been appointed European Representative for Clark Bros. Co., Inc., of Olean, New York and the International Derrick & Equipment Company of Columbus, Ohio and Dallas, Texas. Mr. Galpin spent several weeks in the United States recently, preparatory to assuming his duties abroad. Before joining the above two organizations, Mr. Galpin was with the Anglo-Iranian Oil Company for nine years and six years with the Roumanian Oil Industry. In the late war, Mr. Galpin served with the British Army from 1940 to 1946 as a Lieutenant-Colonel. He is a graduate of Trinity College, Oxford University.

Dr. Robert W. Clark, Chief Geologist for Western Gulf Oil Company, passed away at his home, 1621 Perkins Drive, Arcadia, Saturday, June 5, after several months' illness.

Dr. Clark came to California from the Gulf Oil Corporation, Pittsburgh, Pa., in 1938 to head the geological department of Western Gulf Oil Company and has been active in the affairs and problems of California geologists in their search for oil since that time.

Clark was a member of the American Association of Petroleum Geologists, having taken an active part in arranging the national meeting of that organization held in Los Angeles last year and served as its vice president in 1943. He was also a member of the Geological Society of America, the Society of Exploration Geophysicists and the American Institute of Mining and Metallurgical Engineers, Petroleum Division.

Here's why you get Better Performance and Longer Life with an EMSCO Slush Pump

FABRICATED STEEL POWER END. Fabriform construction provides an extremely rigid, strong and compact unit. Steel skids, built integral with the power frame, considerably reduce pump weight and overall dimensions.

ECCENTRIC ASSEMBLY. One piece eccentric strap equipped with roller bearings at both ends assures quiet, efficient and trouble-free operation. Entire assembly is flood-lubricated from main oil bath.

GEARING. Forged alloy steel herringbone gears maintain perfect axial balance and provide quiet and efficient speed reduction. Two-piece main gear mounted on self-aligning roller bearings.

LUBRICATION. All running parts flood-lubricated by a positive-splash system, eliminating troublesome oil pumps and grease connections. Large diameter, high-capacity roller bearings assure long, trouble-free operation.

CROSSHEADS AND GUIDES. Hard chrome-plated heat-treated steel crossheads run on renewable guides. Heavy duty needle roller bearings used in crosshead pin assembly.

STUFFING BOX COMPARTMENT. Piston rod connects to crosshead extension in large, open compartment for easy piston rod replacement. Power end fully protected against intrusion of mud.

"EXPOSED" LINER. Fluid liners packed off at both ends and exposed to view. This patented construction permits immediate and unfailing detection of mud leakage before serious washouts can occur. Liners can be easily removed as they cannot become locked by sand.

DIRECT FLOW DESIGN. Full openings and large passages permit free, unobstructed fluid flow. This direct flow design assures low fluid velocities and highest volumetric efficiency.

CAST STEEL FLUID END. Electrically welded, cast-steel fluid end provides maximum strength with minimum weight. The all steel construction of the fluid end permits repairs to be made in the field by the utilization of welding.

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"PACEMAKERS IN OIL FIELD EQUIPMENT DESIGN"

THIS LAUGH OFF!!

A small man was holding forth on humanitarianism. "My friends," he said, "you should never, in any circumstances, strike a child. I've brought up six boys myself, so I know what I'm talking about."

"Six boys!" exclaimed a man in the audience. "Do you mean to say you haven't laid a hand on any one of them?"

"Never," replied the lecturer—"except in self-defense."

Foreman: "When I hired you two weeks ago, you told me how good you were. Now tell me all over again—I'm getting discouraged."

Shoulders thrown back proudly, the old mountaineer strode from the village post office when the letter had been read to him.

Outside, he made his way immediately to a gathering of his cronies in the chinaberry's shade.

"My boy, Eph," he announced so that all could hear, "has got his sentence cut down to six months fer behavin' good."

There was quick interest. A grizzled hillbilly raised himself on an elbow.

"It's moughty nice," he commented, "to have a boy that does ye sech credit."

Judge—"Do you challenge any of the jury?"

Defendant—"Well, I think I can lick that little guy on the end."

"Issue a directive, Popoff: tell these people to stop acting as if they're living under the crushing heel of Imperialistic Capitalism!"

A man was looking for a good church to attend and happened into a small one in which the congregation was reading with the minister. They were saying: "We have left undone those things we ought to have done, and we have done those things which we ought not to have done."

The man dropped into a seat and sighed with relief as he said to himself: "Thank goodness, I've found my crowd at last."

An admiral, watching a young inductee labor eagerly but clumsily on the quarter-deck, asked: "How long have you been in the Navy, son?"

"Two months," the boy replied. "How long have you been in?"

The admiral was taken slightly aback, but he good-naturedly answered: "Thirty years."

"It's hell, ain't it?" the youngster said sympathetically.

Master of House—"Why did you tell your mistress what time I came home last night after I had told you to be quiet about it?"

Maid—"I didn't, sir. She asked me what time it was, and I told her I was too busy getting breakfast to notice."

A little boy was put to bed about seven one summer evening and it was still light outside his window.

"Aren't you going to say your prayers?" asked his mother.

"Naw, it's still light out," replied the boy.

"But do you only say your prayers at night?" asked his mother.

"Sure," he replied, "I can take care of myself in the daytime."

Customer: "I want a box of cigars, please."

Clerk: "Yes, ma'am—a strong cigar?"

Customer: "Oh, yes. My husband bites them terribly."

That girl again: "When I found my first gray hair, I thought I had nothing to live for."

That man: "So you dyed, eh?"

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Efficient pumping units aren't designed and made overnight. As a matter of fact, the present efficiency of Jensen units is the result of 28 years of field and manufacturing experience.

This experience has given Jensens gears and bearings that stand the gaff, crank and beam weights that balance any well, bases and structures to withstand any load—in a word, this experience gives Jensens first place in economy and performance.

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Nomads Preparing for Record Whing Ding

The Los Angeles chapter of Nomads will stage on July 16, 1948, beginning at 10 a.m., what promises to be the greatest Whing Ding of all time. Already Johnny Rife, the secretary, is worn to a frazzle answering phone calls at the new Nomads number, Logan 54690, and tickets by the scad are being sold with the ink still wet on them. The affair is to take place this year at Lakewood Country Club, where Howard Cane and Vic Baker have established an enviable reputation for their excellent handling of frolics, whing dings, barbecues, and other such fandangoes.

The program will as usual include flailing the sward, or "golf" as it is laughingly called, under the expert direction of George Trembley, and he has promised to wear a less noisy shirt than he did last year so that the players won't be distracted. Also, he has promised some excellent prizes for the best digging of the day. Call George at Kimball 1281 for your starting time if you plan to do a little excavating. There is also to be pitching horseshoes, with the horses removed, of course, under the able supervision of that erstwhile Iowan, Abe Haglund, and for this, too, believe it or not, there are to be valuable prizes. Last but not least in the sporting department is the gaming, presided over by Ray Humphreys, perhaps the best croupier outside of Monte Carlo. Yeah, perhaps! Ray will also award suitable mementoes to the more accomplished handlers of the colored disks.

From 4:30 to 7:30 p.m., a female accordianist will encourage the eruption of sporadic quartets, and a swell dinner will titivate the most jaded appetite at the end of that time, after which Earle Boggess will trot out his performing seals and provide a floor show to end all floor shows. In the meantime there will be a grand reunion of lost souls, the presentation of prizes, including some valuable gifts that will be given to certain people for merely purchasing tickets with lucky numbers on them. Incidentally, the prizes were purchased by George Anderson, Babe Doyle, and another nameless Scot, who together beat the salesmen down unmercifully and came out with a selection of prizes that has not been equalled since the days of Lee Laird.

Better get that ticket now! If you are a Nomad you can have as many guests as you want for this donnybrook. The ante is $3.00 for golf, which includes green fees, locker room, and all club facilities; $1.00 for horse shoe pitching, which includes the shoes and the mud; and $9.00 per each for the dinner, show, and everything else not already mentioned. Whoopee!

Pictured above are the foreign guests who attended the June Meeting of the Los Angeles Chapter of Nomads: seated left to right: Arthur S. Osborn of the Arabian-American Oil Co.; Ernest E. Woodbury of the Richmond Exploration Co; Mr. Irvin LaGrande of the Drilling & Exploration Co.; standing left to right: R. H. Hume of the Sinclair Oil Co.; Lewis W. Miller of The Texas Petroleum Co.; Douglas Pickard of the Anglo-Iranian Oil Co.

In the Coyote Field, a Standard Oil Company roustabout crew, left to right: Oscar Logan, Earl Duncan, Henry Solesbee, J. A. Cox, Bill Bartee.